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FIRE PROTECTION ENGINEERING SURVEY OF AIR TRAFFIC CONTROL TOWER--ETC(U)
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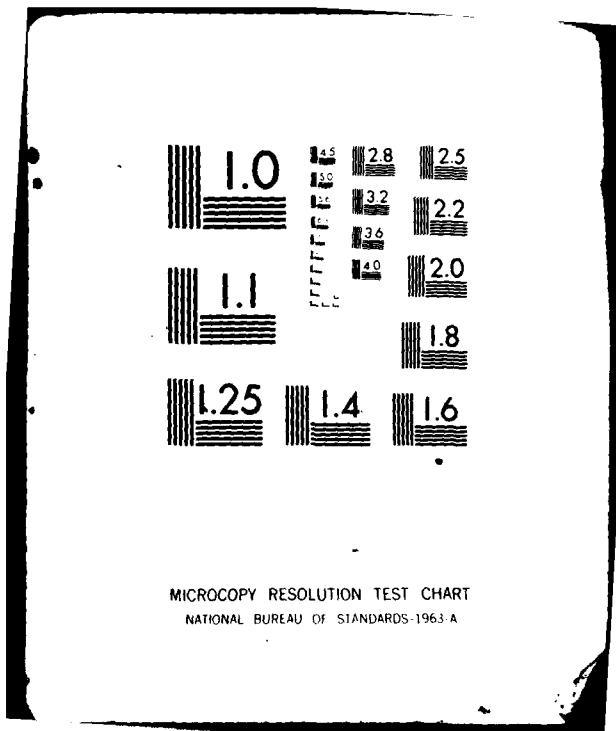
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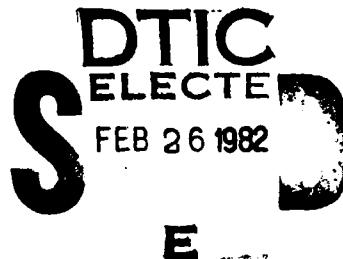


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FIRE PROTECTION ENGINEERING
SURVEY OF
AIR TRAFFIC CONTROL TOWERS



JANUARY, 1977

FINAL REPORT

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16. Abstract <p>Aircraft traffic control towers are a unique structure and many code approaches are neither practical nor effective. The applicable areas of the various codes are discussed. A general fire-safety review of towers is presented. A fire protection engineering survey was conducted for 27 selected control towers to determine compliance with the requirements of OSHA, NFPA and good engineering practice. The towers are categorized as to the degree of compliance. None of the towers were in full compliance. However, with modifications in existing egress systems and the installation of detection/alarm systems the intent of the requirements could be met. A petition is provided for a special occupancy class in the Uniform Building Code.</p>			
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Introduction

Aircraft control towers are a unique structure and many common code approaches to fire safety are neither practical nor effective. Some towers present fire safety problems similar to those associated with high rise buildings although many solutions applicable to high rise buildings could not be applied to towers. In addition, control towers would normally be considered a low fire hazard occupancy but recent serious fires in buildings containing some similar fire hazards indicate a need to evaluate potential fire-life safety hazards in control towers. In addition, modifications may be necessary to bring control towers up to the specific and/or intended requirements of OSHA.

The fire-life safety record in control towers is good; however, the time to identify and correct any hazardous conditions is before rather than after a serious loss occurs. In recognition of the need for identifying hazards and deficiencies in control towers, the Federal Administration has awarded a contract for a Fire Protection Engineering Survey of Air Traffic Control Towers. This report, submitted in response to the contract requirements, describes the technical considerations and the plan to expeditiously and effectively achieve the program objectives.

Objective

A survey consisting of:

- a. Conducting fire protection engineering surveys of life safety features at 27 specified control towers to determine compliance with OSHA Standards, National consensus standard such as NFPA Fire Codes and accepted good fire protection engineering practice applicable to life safety from fire effects for such towers.
- b. Preparing recommended language for use in petitioning for establishment of a realistic occupancy group classification for control towers in the Uniform Building Code.
- c. Categorizing the surveyed structures as to whether they meet the applicable standards of a. above, meet the intent of the standards through alternative means, or are deficient and require modification. All necessary modifications are identified and cost estimates prepared for implementing corrective measures.

The findings and conclusions as a result of the tower surveys are detailed. This final report also contains the justifications for any modifications determined to be necessary.

Authorization and Conduct of the Survey

The survey was authorized by Contract No. DOT-FA76WA-3805 dated April 21, 1976. Preliminary work began on May 12, 1976 with a survey of the air traffic control tower at Meadows Field, Bakersfield, California. This was followed by an oral briefing at Federal Aviation Administration headquarters in Washington, D.C. The briefing provided an opportunity to discuss with cognizant FAA personnel the data acquired during the Bakersfield ATCT survey and to discuss the Engineer's probable approach in assessing the towers to be surveyed.

Surveys of 11 towers took place during the period of June 1-24, 1967; these were surveyed by John L. Carlson, P.E., Senior Fire Protection Engineer. Surveys of an additional 14 towers took place between July 26 and August 10, 1976; these were surveyed by James D. Behn, Staff Fire Protection Engineer. One additional tower was surveyed on August 20, 1976 by Glenn D. Peterson, Staff Fire Protection Engineer.

Mr. Paul D. Smith, P.E., President of Gage-Babcock & Associates, Inc. and Mr. W. E. Backes, P.E., Project Supervisor, provided overall guidance and supervision of the effort. The work was performed under the technical direction of Mr. George McCord, the FAA Contracting Officers' Technical Representative.

Synopsis

Air traffic control towers are a unique kind of structure and many code approaches to life safety are neither practical nor effective. OSHA requirements concerning life safety are contained primarily in Part 1910 - subparts C, L and S. These sections do not specifically relate to control towers but are essentially oriented to industrial and storage occupancies. The NFPA Life Safety Code gives some recognition to towers as special structures and recognizes under certain conditions the adequacy of only one exit for these structures.

Based on the results of this fire protection engineering survey of 27 designated towers it was concluded that a single inside stairway exit would provide an adequately safe means of egress under the following conditions:

- a. The stairwells are enclosed to the extent that all access doors and walls are equivalent to a one hour fire resistance rating with a protected exit path on the ground floor.
- b. All utility chases or shafts are completely enclosed in a manner equivalent to a 1-1/2 hour fire resistance rating.
- c. All floor and/or wall penetrations are sealed in a manner equivalent to a one hour fire resistance rating and are smoke tight.

- d. A properly designed early warning products of combustion detection and alarm system is provided throughout the tower and any contiguous structure(s).
- e. Compliance with good practice procedures for emergency exiting is also necessary. This would include but is not limited to providing emergency lighting, exit signing and unobstructed accessways. It is essential that stairwell access doors are kept closed at all times.

Improvements, with their cost of implementation, are recommended that would be necessary to meet the intent of items a, b, c and d above. Some additional recommendations are made to improve fire-life safety protection but are not considered essential to the overall emergency egress objective.

If there is full compliance with the intent of the recommendations, other means of egress are not considered necessary. Outside ladders, rope and slings, elevators, etc. are not considered by any standard as part of any effective means of egress.

If it is elected by the FAA or tower owner to retain existing exterior ladders, such ladders should be upgraded to meet the recognized requirements for industrial ladder systems.

Applicable Codes and Standards Discussion

OSHA - The major OSHA requirements related to fire safety in control towers are contained in Part 1910 - subpart C, Means of Egress; subpart L, Fire Protection and subpart S, Electrical. All of these are largely taken in part of total from National Fire Protection Association standards. Subpart C is based on NFPA 101, the Life Safety Code. In some ways it is more flexible than the Life Safety Code and in others it is more rigid, because it does not include restrictions and allowances which are permitted by the code itself for different occupancies.

Section 1910 - subpart L, Fire Protection incorporates elements of or by reference all NFPA standards on portable and fixed fire extinguishing appliances, except for those that cover foam, high expansion foam and Halon 1301. In addition, the NFPA standard on local fire alarm systems is also included by reference in this section. Most of these standards, except for portable extinguishers, do not specify that the system must be installed, but only indicate that the Standards must be met if a system is installed. The requirements for the system are defined in other sections of Part 1910, which are oriented to manufacturing and storage occupancies. Some of the general requirements for protection of means of egress in subpart C might require installation of a fire protection system to meet the intent of this regulation. For example, a fire alarm system may be required:

1910.36b (7) In every building or structure of such size, arrangement, or occupancy that a fire may not itself provide adequate warning to occupants, fire alarm facilities shall be provided where necessary to warn occupants of the existence of fire so that they may escape, or to facilitate the orderly conduct of fire exit drills.

Subpart S, Electrical, is actually NFPA 70, the National Electrical Code, which encompasses fire-life safety, shock and property protection requirements.

Other OSHA regulations may have some partial application to fire safety in a particular control tower. In particular, subparts on Hazardous Materials and Compressed Gases would have to be considered if these materials are used or stored in some towers. None of the towers surveyed contained any such materials, however.

Some of the OSHA fire safety regulations are not necessarily applicable to life safety. In some instances such a regulation may even decrease life safety. For example, fire extinguishers are required, but the safest thing for an occupant to do is evacuate rather than fight a fire. However, if a fire is not suppressed by a portable extinguisher, there are conditions under which the fire might endanger or trap others. The emphasis in these surveys is on life safety. Nevertheless, it is recognized that many basic property protection requirements also effectively contribute to occupant life safety.

NFPA - The Life Safety Code gives consideration to towers as unique structures by requiring only one approved exit if:

- a. The tower is of such size as not to be subject to occupancy by more than 25 persons on any one floor level.
- b. The tower is subject only to occupancy by able-bodied persons and is not used for living or sleeping purposes.
- c. The construction is fire-resistive, noncombustible or heavy timber. The interior finish, if any, is Class A Class B (Section 6-2), and there are no combustible materials in, under, or in the immediate vicinity of the tower except necessary furniture such as chairs or benches.

In addition, the code permits use of unenclosed or fire escape type stairs on towers meeting the above conditions which have only a top level occupancy. All existing towers may use fire escape or outside stairs for egress under this code, but new towers must be provided with Class B stairs unless exempt by the previously listed exception. It should be noted that none of the codes or standards permit the use of elevators as a required means of egress.

All of the towers surveyed met the requirements of the preceding items b and c. Some towers especially those not constructed by the FAA are subject to occupancy by more than 25 persons on some floor levels (item a). These however are generally on "non-tower" floors or occupancies. That is the tower per se is part of a larger terminal building complex. The so called nontower areas would be such occupancies as airport offices, air carrier terminal areas, restaurants, etc. Large base buildings, such as at Dallas-Ft. Worth also have more than 25 occupants.

However, OSHA requirements are more generalized and also express the real intent of the Life Safety Code.

1910.36b (8) Every building, or structure, section or area thereof of such size, occupancy, and arrangement that the reasonable safety of numbers of occupancy may be endangered by the blocking of any single means of egress due to fire or smoke, shall have at least two means of egress remote from each other, so arranged as to minimize any possibility that both may be blocked by any one fire or other emergency conditions.

NFPA Standard 90A, Air Conditioning and Ventilating Systems, contains criteria and recommendations related to smoke control which could supplement the following general OSHA requirements:

1910.36b (2) Every building or structure shall be so constructed, arranged, equipped, maintained, and operated as to avoid undue danger to the lives and safety of its occupants from fire, smoke, fumes, or resulting panic during the period of time reasonably necessary for escape from the building or structure in case of fire or other emergency.

However, meeting the requirements of 90A will not prove adequate to provide the necessary protection in the confined spaces of all control towers. Professional judgement (considering recent actual smoke movement investigation results) is the basis for evaluating smoke spread hazards and preparing smoke control recommendations, where necessary. Although tracer gas movements did at first appear promising for evaluating smoke movement, recent full scale tests indicate the tracer gases move very much faster than real smoke. Basic design parameters for smoke control systems are discussed in "Fire/Smoke Behavior" section of this report.

Fire-Life Safety Hazards - General

The control towers surveyed were located either on top of another airport building or were free-standing, independent structures. In the former arrangement, the tower is exposed to fire hazards within itself and to those emanating from within the building it is on. However, in such an arrangement the vertical evacuation distance from the tower to the main building is relatively short and the evacuees have two or more means of egress from the main building, once at that level.

The independent tower is primarily exposed to internal fire hazards and the degree or abatement of any such hazards, can be more closely controlled by FAA. However, the occupants in most cases have to evacuate by a long, high stairway. Nineteen of the 27 towers surveyed did not exceed normal building code height limits defining high rise buildings (typically 75 feet) and they do not meet the functional definitions of high rise buildings:

Major potential fire-life safety hazards internal to a tower include:

- a. Interior Finish
- b. Power and communications wire insulation.
- c. Electrical power devices, particularly oil-insulated components.
- d. Emergency power generating systems
- e. Air conditioning filters and duct insulation
- f. Interior furnishings

Where combustible, these items are serious hazards because of either direct fire exposure to tower occupants and/or generation of smoke. The smoke could initially block egress from the tower and then create a lethal environment within occupied spaces. All of these items, except for cable insulation, are available with limited combustibility but items of moderate combustibility have been installed in some cases.

Minor fire hazards such as personal comfort items, paper and electronic equipment usually do not present a serious fire-life safety hazard. However, they are so considered because of circumstances in which by themselves or in combination with other combustibles, a significant hazard is created.

Tower structures which are of combustible construction could also present a significant potential hazard to occupants, although all towers surveyed are of noncombustible or better construction. Noncombustible tower supports could collapse

under either an external or severe internal fire exposure, but such collapse would be unlikely in early fire stages. It is the early fire stages which are important from an occupant life safety consideration.

Wire and Cable Chases - Chases for electric power and electronic signaling wires have a potential for serious fire, even though the probability of ignition may be low. Recent incidents at the World Trade Center, Browns Ferry Nuclear Generating Station and a New York Telephone Exchange demonstrated the severity of fires primarily involving only wire and cable insulation. The fire hazard is increased when wire and cable are run in tall vertical chases that permit uninterrupted vertical flame movement. It is difficult to effectively firestop such chases or entrances to them. However, even when the fire can be confined, large volumes of lethal smoke may spread outside the chase.

On the other hand, fire involving wire and cable may also present a serious property loss and functional interruption hazard, but may not present a serious life safety hazard to occupants of the structure. And some arrangements present both an occupant life safety and a property/function loss potential.

Smoke Movement - Control towers, particularly the independent type, may exhibit some of the same smoke and fire movement characteristics as in high rise buildings. For example, the interior pressure in a closed structure 175 feet high will be 2.5 inches of water lower at the top than at the bottom under 72°F. day and 2.85 inches lower on a 10°F. day, (assuming an adiabatic lapse rate). Obviously the potential for internal and internal-external flow exists, and depend on the external environment and the tower ventilation, particularly the point where the internal-external pressures are equal. This may occur anywhere from the base to top.

Wind effect can increase exterior pressure on the windward side and decrease it on the leeward and top sides. With no wind effects, an internal chase that is vented at the top will be below the interior pressure at most levels on a cold day, so the flow of smoke will be into such a chase. However, on a hot day the top-vented chase would be at a slightly higher pressure than the interior, so smoke in the chase would flow into the tower. Wind effects can influence this and can be used to provide positive venting under all but very calm day conditions. Obviously, a slight mechanical assist would insure such a chase being always below the tower's interior pressure. Tower ventilation and changes in chase ventilation can also be used to control smoke movement hazards and to adjust the natural smoke movement so it tends to keep smoke from the means of egress and occupied areas.

Special Problems - Unique problem areas associated with control tower fire safety include:

- a. The common structural technique of providing two alternate

and remote exits is not feasible. Even if a second exit were provided, it generally would provide no increase in safety because it would be subject to the same potential loss of use as the first.

b. Means of egress will often be usable only for a limited period of time after a fire has developed. However, the decision to evacuate a control tower at a busy airport could not be made at the first hint of fire and might be delayed until a serious fire hazard had developed.

c. Then a tower is located on a building, the FAA may not be able to force compliance with fire safety recommendations within the main building. Alternate approaches may have to be implemented to provide the proper level of safety from such potential exposures.

Fire/Smoke Behavior - Fires in a control tower facility will normally be "ventilation-controlled", that is, the burning rate will be limited by the air available for combustion. The smoke produced will be proportional to the burning rate, but additional dangerous gases may be produced by the thermal decomposition of some electrical insulating materials, which can occur below their ignition temperature. Although these fires may eventually progress to a well-ventilated and freely burning fire, this normally occurs well after the period of interest for life safety purposes.

In its embryonic stage, the combustion rate will be surface-area limited. However, as it develops, the burning rate will quickly be limited by the air available for combustion. The "ventilation-controlled" fire can be at or within two extremes. The first would occur in a well ventilated space, such as a room with an open window. The second extreme would be a dormant stage, typical of a fire in a room with closed doors and windows. The well ventilated stage is characterized by relative, complete combustion and high temperatures within the fire room. The moles of combustion gas produced will be about 5 percent greater than the moles of air entering the zone of combustion. Combustion products temperature will average around 1300°F with peak temperatures 200-300°F higher. The resultant smoke produced will be about 3-1/2 times the volume of air that enters the zone of combustion and will have a relatively low concentration of carbon monoxide.

The dormant burning stage is characterized by incomplete combustion and consuption of a large percentage of the oxygen in the air that enters the zone of combustion. The amounts of air necessary to consume a pound of cellulose material in the dormant stage of burning is about 1/7 of that in the freely burning stage. The average combustion products temperatures in the dormant stage will be about 400°F, although temperatures in the zone of combustion will be higher. The moles of combustion products will be about 15 percent greater than the moles of

air entering the zone. Consequently, the volume of smoke produced will be about twice that of the volume of air that enters the combustion zone. However, this smoke will contain a very high concentration of carbon monoxide and, when typical electrical cable insulation is involved, of chlorinated hydrocarbons.

A room fire in the freely burning stage will go into the dormant stage when the room door is closed. Similarly, a fire in the dormant stage will go into a freely burning stage when a door is opened, a window broken or other ventilation provided.

A fire in a compartment will draw air in at a low level and tend to exhaust combustion products at a high level. The pressure inside the fire compartment will generally be below that of the surrounding areas when there is inflow, and above that of surrounding areas at upper levels and other points of outflow. The maximum pressure generated by fire gases can approach 0.1 inches of water, although higher transient pressures can occur during a sudden influx of fresh air.

Combustion gas pressures and smoke volume provide criteria for design and evaluation of smoke control mechanisms. The probability of smoke contamination of occupied spaces and means of egress is also related to these parameters and the tightness of doors, smoke dampers, and fire dampers in compartments and HVAC ducts. Typical smoke leakage parameters at a pressure differential of 0.1 inch of water are:

Standard B Label Fire Doors	- 8-1/2 cfm/ft-perimeter
Gasketed Air Control Dampers	- 2 cfm/ft ²
Fire Damper	- 12 cfm/ft ²
Air Control Damper, no gasket	- 25 cfm/ft ²

Smoke pressure, volume and leakage are important in design of smoke control systems and in evaluation of possible smoke contamination. However, actual fire experience and full scale tests have shown that under both freely burning and dormant fire conditions an ordinary fire door with a typical fit will prevent small contamination of the means of egress for a minimum of 10 minutes and usually much longer. When smoke must pass through two doors to contaminate a means of egress, the means of egress will remain usable generally until one door fails. In common building fires, means of egress are often contaminated by smoke because doors are opened during fire fighting operations.

Egress - the basic fire-life safety emphasis in all codes and standards is providing exits so people can evacuate from the dangers of fire. This is so completely ingrained in codes that in occupancies where people are unable to use the type of

exists anticipated by the code, the solution has been to require more exits of the type the occupants cannot use. However, the intent of codes and the requirements of OSHA standards is to provide a safe means of egress to permit all occupants to leave the fire area to a place of safety. The exitways must remain usable for the period necessary to evacuate the building. A large safety factor is normally included to compensate for delays in alerting occupants and to provide safe access to the fire by the fire department.

Protection of Exitways - OSHA regulations (1910.36b2) and good fire protection engineering practice dictate that building occupants are not exposed to undue danger from a fire environment during the time required to escape from the building. Until recently this was satisfactorily obtained by limiting exit travel distance, providing two ways out and providing one hour (or greater) fire resistive stairway enclosures with self-closing, fire-rated doors. With tall buildings, the evacuation time down stairways increased and in a number of fires, smoke blocked stairways and prevented their use. New criteria were developed which specified that fire gas contamination be limited to 3 percent within any means of egress. This has been applied in GSA fire-safety systems analysis conducted by Gage-Babcock in some local building codes for high rise buildings.

The potential contamination from a fire that can enter a means of egress may be determined for some egress configurations and may be used as a design criteria. However, actual fire experience has indicated that some means of egress are inherently safe for certain periods of time. A normal enclosed stairwell in a 200 foot high building will generally be passable for at least five minutes even when doors into it are being frequently opened or closed. If doors to different levels remain closed, a stairway will remain free of excessive fire gas contamination for 15 to 25 minutes, although an elevator shaft may be contaminated within one minute. Actual fire incidents have shown that when there is no opening into a fire level from a stairway or elevator shaft, these shafts will remain smoke-free for an extended period. Similarly, a smoke-proof ATC tower stairway will remain smoke free for an extended period.

Therefore, the following exits can be assumed to provide an adequate level of protection from smoke and fire assuming all have adequate fire resistance with appropriate self-closing doors:

- a. An enclosed stairway when the occupants can evacuate within five minutes.
- b. An enclosed stairway with significant fire hazard only at unpopulated levels and which can be evacuated in 15 minutes.
- c. An enclosed stairway of a smoke-proof tower configuration for an indefinite period.

d. An enclosed stairway which has no openings into potential fire levels for an indefinite period.

When a means of egress does not provide protection from fire gas contamination for sufficient time to evacuate, ventilation and/or pressurization of the stairway can control entry of contaminants.

No fire safety code recognizes the elevator as a means of egress under fire conditions. Good fire protection practices dictate elevators should not normally be used to evacuate a building. However, actual fire experiences show elevators can be used safely when:

- a. The elevator shaft has no openings on the fire level.
- b. Power and control wires are not exposed to heat.
- c. Electric power supply to the elevator cannot be directly or indirectly interrupted as a result of the fire.
- d. Photoelectric interlocks can be disabled.

Alternative and Redundant Protection - Good practice and OSHA regulations mandate redundant protective features so that reliance for safety to life in case of fire or other emergencies will not depend solely on a single element. Many codes may actually specify 6 or 7 levels of redundancy although it is doubtful such is the actual intent of the code. Multiple levels of redundancy provide increasingly smaller improvements in life safety and generally significantly increase the costs, so that this approach generally has a very low cost-effectiveness.

Any approach that is both cost-effective and life-safety-effective has to provide a basic level of protection with a limited number of reliable redundancies. Because of the operational importance of an ATC tower and a high property value, protection options should be those which safeguard both lives and property.

Two basic protective methods which are always included are fire prevention and adequate means of egress. Fire prevention reliability can often be considerably improved over what a code may require. In addition, code requirements usually dictate at least two means of egress, whereas the same level of reliability can often be achieved by providing additional protection for a single means of egress. Some other fire-life safety alternatives include:

- a. Limiting the fire to a small size so it creates no hazard. This can be achieved by either confinement and/or control of combustibles.
- b. Promptly extinguishing a fire while it is small. This requires manual or automatic detection as well as manual or automatic extinguishment. Automatic detection and alarm can materially enhance the adequacy of a single exit.
- c. Limiting the spread of fire and smoke into occupied areas of physical confinement, venting or pressurization.

Basis For Petition for ATC Tower Occupancy Recognition and
UBC Classification

General - The Life Safety Code (NFPA 101-1973) recognizes the uniqueness of towers in only requiring a single stairway exit under certain conditions:

16-111. Any tower occupied for purposes such as observation, signaling, either an independent structure or on top of a building shall be permitted with a single stairway or ramp exit if all of the following conditions are met:

(a) The tower is of such size as not to be subject to occupancy by more than 25 persons on any one floor level.

(b) The tower is subject only to occupancy by able-bodied persons and is not used for living or sleeping purposes.

(c) The construction is fire-resistive, noncombustible or heavy timber. The interior finish, if any, is Class A or Class B (see Section 6-2), and there are no combustible materials in, under, or in the immediate vicinity of the tower except necessary furniture such as chairs or benches.

A survey of 27 ATC towers revealed that all towers surveyed would meet these criteria. However, UBC does not have an equivalent classification of treatment. The following is offered as a suggested petition to the International Conference of Building Officials (ICBO) for such recognition and classification.

This petition does not attempt to "write" a new occupancy classification for ATC towers under the Uniform Building Code. Rather, it seeks to establish the uniqueness of ATC tower structures and to justify the need for recognition of this uniqueness through an appropriate occupancy classification. It is submitted that the building code aspects of ATC towers as well as of all other occupied tower structures, such as railroad signal towers and forest fire observation towers, both of which are recognized by and treated in the Life Safety Code, cannot be adequately or realistically treated by the current Uniform Building Code.

The petitioner is convinced that an entirely adequate and acceptable degree of life safety can be achieved in a typical ATC tower with, for instance, a single exit stairway, enclosed and adequately separated from other parts of the building in each story, and an automatic products of combustion detection and alarm system with its own standby emergency power system, connected to the airport fire department. This solution is certainly more realistic than the provision of two stairways

twenty feet apart and both equally susceptible to loss of use from the same cause. Neither this kind of realistic treatment of ATC towers nor that of more difficult and complicated situations where an ATC tower rests above or otherwise in conjunction with a more conventional structure is possible unless the unique characteristics of an ATC tower itself are recognized in the Code and adequately and realistically treated.

Current Classification of ATC Towers - The 1976 edition of the Uniform Building Code recognizes "towers" in Chapter 36, Pent-houses and Roof structures, Section 3602, Towers and Spires, but apparently fails to recognize that some tower structures are occupied by people, since no part of Section 3602 deals with occupancy aspects of tower structures.

Thus, it is necessary in seeking to classify an ATC tower to find an occupancy category into which such a tower will fit. There is general agreement that an ATC tower is classified most closely in Group B-2, which includes stores, office buildings, police and fire stations, etc. The process by which this classification is made, however, is perhaps more one of elimination than selection; eliminating those into which it will definitely not fit until one is left with B-2.

Requirements Imposed by Current Classification - Once the B-2 classification is made, Table 5-D, Maximum Height of Buildings (as a function of occupancy group and construction type) and Table 33-A, Available Square Feet per Occupant and Egress Facilities, are found to introduce a number of serious problems to the designer attempting to design a functional air traffic control tower at a reasonable cost under the UBC. Unless the tower is to be of fire resistive construction, its height is limited to 4 stories.

Moreover, exits must be designed on the basis of one occupant per 100 sq.ft. of floor area, and Section 3302(a) requires two exits in every story above the first, regardless of occupant load. This means that a tower with a typical square plan area of from 600 to 1000 sq.ft. would be required to have two separate exits from every story. Assuming these would both be interior stairways and using dimensions for a typical 1024 sq. ft. plan per floor, 32 feet square, the two stairways could not be further apart than approximately 16 to 20 feet! Assuming one interior and one outside stairway, they still could be no further apart than approximately 24 to 30 feet.

It is not desirable from several standpoints to construct smaller ATC towers of fire resistive construction. If it were, the existing height restrictions would permit needed heights to be built but the problem of multiple exits would remain.

Physical and Operational Requirements for ATC Towers - In spite of the increased reliance of air traffic controllers on electronic equipment of various kinds, it is nevertheless of prime importance that controllers on duty have optimum visual command

of an airport and its surroundings. This can only be provided by locating their normal vantage point, the controllers "cab", at a considerable height above the airport terrain; the larger the airport area to be observed, the greater the necessary height. At smaller airports the minimum cab height needed is 5 to 7 stories above grade.

Cab population during maximum duty hours varies from 3 to as many as 10 persons. In larger towers at major airports, there are additional controllers monitoring radar scopes, usually in a viewing room on a separate floor. Aside from the visual and radar controllers, personnel needs are minimal and are restricted to one or two supervisory personnel, one or two maintenance personnel and a clerk or secretary; this handful of people share the remaining 4 to 6 stories in a typical tower structure, an approximate average of 1 or 2 persons per story. Thus, an ATC tower is a unique structure from the standpoints of both its required configuration and its personnel occupancy and loading pattern. It is quite apparent that there is not now an occupancy classification which adequately and equitably accommodates air traffic control towers.

Summary, Conclusions and Deficiencies

Air Traffic Control Towers are a special type of building that does not fit precisely into a specific code category. The towers are unique in that they have very small floor areas, small populations, are relatively remotely located, and have limited protection. Tables No. 1 and 2 summarize conditions and deficiencies for all 27 of the towers surveyed. (See the Appendix for details)

Table No. 1 - Tower Categorization lists all the Towers by 23 identification features common to all the towers surveyed. This enables a quick comparison of the towers by type and region. Some of the features may need additional clarification as to intent.

- Item C - Region is the FAA operational region.
- Item D - Type is the type of tower as given in Attachment 1 to Exhibit "A" of the contract.
- Item E - Category refers to the categorization of the towers as listed in Exhibit "A" - Statement of Work of the contract. Category C is for towers which are deficient and require modification to achieve compliance with the applicable standards and accepted good practice.
- Item F - Construction - classifies the tower construction on the basis of NFPA 220 Standard Types of Building Construction.
- Item G - Indep. Structure identifies whether a tower is an individual building or part of or located on another structure such as a terminal building.
- Item I - Area/Floor indicates the range of floor areas per tower which may differ by floor and in most cases the cab has a smaller area than the other floors.
- Item P - Unprotected Shaft/Floor indicates whether the tower shafts have openings or penetrations that are not fire and smoke resistive.
- Item S - Interior Finish classifies the floor, wall ceiling coverings as noncombustible or combustible.
- Item T - HVAC Deficiencies refers to the existence of deficiencies in heating, ventilating and air conditioning equipment.
- Item U - Automatic Sprk. indicates if there is an automatic sprinkler installation.
- Item W - Alarms Supervised indicates if an installed detection system upon actuation automatically transmits notice to the local fire department or protection agency.

TABLE NO. 1
TOWER CATEGORIZATION (1 OF 6)

A	TOWER NO.	1	2	3
B	LOCATION	KANSAS CITY	KINSTON	COLUMBUS
C	REGION	CENTRAL	SOUTHERN	GRT. LAKES
D	TYPE	AVCO	AVCO	AIRAPLANE
E	CATEGORY	C	C	C
F	CONSTRUCTION	NONCOM	NONCOM	NONCOM
G	INDEP. STRUCTURE	YES	YES	YES
H	NO. FLOORS	6	6	7
I	AREA/FLOOR	225-305	225-305	144-576
J	CAB HEIGHT - FT.	54	54	60
K	CAB POPULATION	2	5	5
L	24 HR. ATTEND.	NO	NO	NO
M	ELEVATOR	YES	YES	YES
N	STAIRWELL	OPEN	OPEN	OPEN
O	OTHER EGRESS	OUTSIDE LADDER	OUTSIDE LADDER	NONE
P	UNPROT. SHAFT/FLOOR	YES	YES	YES
Q	EMERGENCY POWER	NO	NO	NO
R	EMERGENCY LIGHTS	?	YES	YES
S	INTERIOR FINISH	NONCOM	NONCOM	COMN. L
T	HVAC DEFICIENCIES	NO	NO	NO
U	AUTOMATIC SPRK.	NONE	NONE	NONE
V	SMOKE DETECTION	NONE	NONE	NONE
W	ALARMS SUPERVISED	-	-	-
X	REMARKS			¹ PARTIAL

TABLE I(2 OF 6)

A	4	5	6	7	8
B	OWENSBORO	PARKERSBURG	GRAND IS.	WARWICK	BAKERSFIELD
C	SOUTHERN	EASTERN	CENTRAL	NEW ENG.	WESTERN
D	AIRAPLANE	AIRAPLANE	HUNT	HUNT	MOCK
E	C	C	C	C	C
F	NONCOM	NONCOM	NONCOM	NONCOM	NONCOM
G	YES	YES	YES	YES	YES
H	7	7	4	8	6
I	144-576	144-576	225-305	400	1025(375) ¹
J	60	60	34	70	64 ²
K	5	5	3	7	3
L	NO	NO	NO	YES	NO
M	YES	YES	NO ¹	YES	YES
N	OPEN	OPEN	OPEN	OPEN	OPEN
O	NONE	NONE	OUTSIDE LADDER	OUTSIDE LADDER	ROPE & SLING
P	YES	YES	YES	YES	YES
Q	NO	NO	NO ²	NO ¹	NO
R	YES	YES	YES	?	YES ³
S	COMB ¹	COMB ¹	NONCOM	NONCOM	NONCOM
T	NO	NO	NO	NO	YES
U	NONE	NONE	NONE	NONE	NONE
V	NONE	NONE	NONE	NONE	NONE
W	-	-	-	-	-
X	¹ PARTIAL	¹ PARTIAL	¹ HOIST SHAFT ² ONLY ² PARTIAL BATTERY	¹ ON ORDER	¹ CAB ² ESTIMATE ³ PARTIAL

TABLE 1 - (3 OF 6)

A	9	10	11	12	13
B	BOISE	EVANSVILLE	FAYETTEVILLE	GREENSBORO	LINCOLN
C	NORTHWEST	GRT. LAKES	SOUTHERN	SOUTHERN	CENTRAL
D	MOCK	MOCK	MOCK	MOCK	MOCK
E	C	C	C	C	C
F	PR. NONCOM.	NONCOM	NONCOM	NONCOM	PROT. NONCOM.
G	YES	YES	YES	YES	YES
H	7	6	5	7	7
I	1090(400) ¹	1025	1090(384) ¹	1090(384) ¹	1090(400) ¹
J	74	64	50	74	75
K	5	10	10	5	5
L	YES	YES	YES	YES	YES
M	YES	YES ¹	NONE	YES	YES
N	OPEN	OPEN	OPEN	OPEN	OPEN
O	ROPE & SLING	OUTSIDE LADDER	NONE	NONE	NONE
P	YES	YES	YES	YES	YES
Q	YES	YES	YES	YES	YES
R	YES	YES	YES	YES	YES
S	NONCOM.	NONCOM.	NONCOM.	NO NCOM.	NONCOM.
T	NO	YES	NO	NO	NO
U	NONE	NONE	NONE	NONE	NONE
V	YES	PARTIAL	NONE	NONE	YES
W	NO	NO	-	-	NO
X	¹ CAB	¹ ENCLOSED	¹ CAB	¹ CAB	¹ CAB

TABLE 1 - (4 OF 6)

A	14	15	16	17	18
B	PORTLAND	BALTIMORE	BOSTON	CHANTILLY	KANSAS CITY
C	NEW:ENG.	EASTERN	NEW:ENG.	EASTERN	CENTRAL
D	NOCK	NON FAA	NONFAA	NONFAA	NONFAA
E	C	C	C	C	C
F	NONCOM	FIRE RES	FIRE RES	NONCOM	FIRE RES
G	YES	NO	NO	NO	NO
H	6	6 ¹	6 ²	4 ¹	6 ¹
I	1025	2	1	2	690(530) ¹
J	64	80 EST	309	185	55
K	6	6	NOTE ₁	6	NOTE 3
L	NO	YES	1	YES	YES
M	YES ¹	YES	YES 3	YES 3	NONE
N	ENCLOSED	OPEN	ENCLOSED	ENCLOSED	ENCLOSED 2
O	NONE	NONE	NONE	NONE	OUTSIDE LADDER
P	YES	YES	YES	YES	3
Q	YES	YES	YES	YES	NO
R	YES	YES	YES	YES	NO ⁴
S	NONCOM.	COM. ³	NONCOM.	NONCOM.	NONCOM.
T	NO	NO	1	YES	3
U	NONE	NONE	NONE	NONE	NONE
V	PARTIAL	NONE	PARTIAL	PARTIAL	NONE
W	NO	--	YES	YES	--
X	¹ ENCLOSED	¹ TWR ONLY, 8 TOTAL ² UNKNOWN- ³ PARTIAL	¹ UNKNOWN ² TWR ONLY, TOTAL OF 22 ³ ENCLOSED	¹ TWR ONLY, TOTAL 14 & BASEMENT ² UNKNOWN ³ ENCLOSED	¹ CAB ² SOME DEFIC. ³ COULD NOT BE SEEN ⁴ ON ORDER

TABLE 1 (5 OF 6)

A	19	20	21	22	23
B	MILWAUKEE	LANCASTER	MUSKEGON	SAN DIEGO	LOUISVILLE
C	GRT.LAKES	EASTERN	GRT.LAKES	WESTERN	SOUTHERN
D	NONFAA	0	0	0	PEI
E	C	C	C	C	C
F	NONCOM	NONCOM	NONCOM	NONCOM	FIRE RES ¹
G	NO	YES	YES	YES	YES
H	4 ¹	6	6	6	5
I	2	880 MAX	880 MAX	400-1500	340 ²
J	2	49	49	49	70
K	5	4	4-7	5	5
L	YES	NO	YES	YES	YES
M	YES ³	NONE	NONE	NONE	YES
N	ENCLOSED	OPEN	OPEN	OPEN	OPEN
O	OUTSIDE FIRE ESCAPE	OUTSIDE LADDER	OUTSIDE LADDERS	OUT.LADDERS/ROPE-SLING	NONE
P	YES	YES	YES	YES	YES
Q	YES	NO ¹	NO ¹	YES	YES
R	YES	YES	YES	YES	YES
S	COMB.	NON.COMB.	NON.COMB.	NON/COMB.	NON.COMB.
T	NO	NO	NO	YES	NO
U	NONE	NONE	NONE	NONE	NONE
V	NONE	NONE	NONE	NONE	NONE
W	-	-	-	-	
X	¹ TWR.ONLY, ² 6 TOTAL ³ UNKNOWN ENCLOSED	¹ BATTERIES FOR SOME EQUIPMENT.	¹ SOME BATT+ TERY OPER- ATION		¹ NONCOMB.BASE BLDGs. ² APPROX. LAR- GER BASE BLDG.

TABLE 1 (6 OF 6)

A	24	25	26	27
B	ANDREWS	MIAMI	DFW	SAN JOSE
C	EASTERN	SOUTHERN	SOUTHWEST	WESTERN
D	PEI	S.R.DESIGN	W.BECKET	W.R.DESIGN
E	C	C	C	C
F	FIRE RES ¹	NON.COM.	NON.COM. ³	NON.COM.
G	YES	YES	YES	YES
H	17	8	4 ¹	3
I	340 ²	625	370-1260 ²	440
J	121	90	180	28-1/2
K	7	5	7	4
L	YES	NO	YES	NO
M	YES	YES	YES ⁴	NONE
N	OPEN	OPEN	ENCLOSED	OPEN
O	NONE	NONE	NONE	ROPE-SLING
P	YES	YES	YES	YES
Q	YES	YES	YES	YES
R	YES	YES	YES	YES
S	NONCOM	NONCOM	NONCOM	NONCOM
T	NO	NO	NO	NO
U	NONE	NONE	NONE	NONE
V	NONE	NONE	PARTIAL	NONE
W	--	-	YES	-
X	¹ NONCOM. ² BASE BLDG. ³ APPROX., LARGER BASE BLDG.		¹ NOT EQUIALLY SPACED ² 31,000 SQ.FT. BASE BLDG. ³ FIRE RES. LOAD BEAR. TWR. ⁴ ENCLOSED	

Table No. 2 - Tower Deficiencies is a listing by tower of the most prevalent and pertinent deficiencies found in the survey. Some explanation of certain headings follows:

Shaft Not Fully Enclosed - refers to shafts other than stairwells and major access openings not unsealed penetrations.

Duct. Detec. Not Auto Shutdown - refers to the automatic shutdown of air handling equipment upon smoke detection (in cases where detectors are provided).

Excessive Combus. - refers to an excessive amount of combustible materials being stored in the tower.

Inadequate Access Doors - refers to doors, opening to stairwell - lobby areas not being suitable for use in escape areas or routes.

No Class A Fire Ext. - refers to the lack of fire extinguishers suitable for use on ordinary combustible materials such as would be found in office and storage areas of the tower.

A.S. Protection Required - refers to towers where it is felt an automatic sprinkler system is needed.

Restricted Exitways - refers to exit ways restricted or reduced in width by improper storage arrangements.

TOWER NO. ①	A	AP	H	M	NF	O	P	S _D M _B T _{RD}																			
DEFICIENCY-CODE REF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
STAIRWELL NOT ENCLOSED	②	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
SHAFTS NOT FULLY ENCLOSED	③	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
UNSEALED PENETRATIONS	④	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
NO SMOKE DETECTION ALARM	⑤	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PARTIAL SMOKE DETECT.	⑥	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DUCT DETECT. NOT AUTO SHUTDOWN	⑦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
EXCESSIVE COMBUST.	⑧	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
COMBUSTIBLE INTERIOR FINISHES	⑨	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
INADEQUATE ACCESS DOORS	⑩	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
ESCAPE CORRIDOR REQUIRED	⑪	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
NO CLASS A FIRE EXIT	⑫	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
A.S. PROTECTION RECOMMENDED	⑬	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
INADEQUATE EMERGENCY LIGHTING	⑭	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
INADEQUATE EMERGENCY PROCEDURES	⑮	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
RESTRICTED EXITWAYS	⑯	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
MISC. ADDIT. DEFIC. (SEE TOWER REPORTS)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

(SEE NEXT PAGE FOR CODE REFERENCES)

TOWER DEFICIENCIES

TABLE 2

Table 2 Code References

1 - See Tower Numbering System page for location.

The following indicate the applicable code reference for the correspondingly numbered item in the table deficiency column.

2 - UBC Chap. 37, OSHA subpart E

3 - UBC 1706, OSHA subpart E

4 - UBC, Chap. 11 & 17, OSHA subpart E

5 to 8 - Recognized good practice not UBC or OSHA deficiencies

9 - UBC Chap. 24, OSHA subpart E

10 - UBC Chap. 33, OSHA subpart E

11 - UBC Chap. 33, OSHA subpart E

12 - OSHA subpart L

13 - (as 5)

14 - UBC Chap. 33, OSHA subpart E

15 - (as 5)

General Categorization - The Tower Categorization Tabulation does not indicate any clear cut characteristic or finding by a particular location or area. There are some general composite characteristics by type of tower (see Categorization by type). However, several items are common to most towers. Twenty of the towers surveyed are of noncombustible construction, 5 are fire resistive (mostly non-FAA constructed) and 2 are protected noncombustible. Only the 5 non-FAA constructed towers are not independent structures. One tower is 3 stories in height, 4 are 4 stories, 2 are 5 stories, 10 are 6 stories, 6 are 7 stories, 2 are 8 stories, 1 is 17 stories and 1 is 22 stories. Area per floor varies from 144 sq.ft. to 1260 sq.ft., some have larger base buildings (31,000 sq.ft. DFW). The cab population varies from 2 to 10 with most (17) in the range of 5-7. However, 10 towers do not operate on a continuous basis so would be totally unattended at times. All (20) towers in excess of 50' high have elevators. Six of the towers had enclosed stairwells. Thirteen of the towers had methods of leaving the towers other than elevators or stairs. None of the towers had an excessive amount of combustible finishing materials. None of the towers had any automatic sprinkler protection. Two of the towers had smoke detection systems although five additional towers had partial systems.

Categorization by Type - Categorization of the towers would indicate the following composite characteristics by type:

Avco - Hunt (4 towers) - Noncombustible construction; 6 Floors; 300 sq.ft. cab; elevator provided if over 50 ft. high; open stairwell; have alternate emergency escape means (non-code); unprotected shafts; no emergency power provided; no consistency in cab height or population.

Air-A-Plane (3 towers) - Noncombustible construction; 7 Floors; 144 sq.ft. per floor; cab height 60 ft; cab population 5; open stairwell; no alternate escape means; unprotected shafts; no emergency power, elevator provided.

Mock (7 towers) - Noncombustible or better construction; about 1000 sq.ft. per floor; elevator provided if over 50 ft. high; mostly open stairwells, unprotected shafts; most have emergency power; 3/4's have some degree of smoke detection; there is no consistency in the number of floors, height, cab population or provision of alternate emergency escape means.

Type O (3 towers) - Noncombustible construction; 6 floors; 880 sq.ft. per floor; 49 ft. high; cab population about 8; no elevator; open stairwell; have alternate emergency escape means; unprotected shafts; most do not have emergency power.

Pei (2 towers) - Fire resistive construction; 340 sq.ft. per floor, cab population is about 6; elevator is provided, open stairwell, no alternate emergency means of egress; unprotected shafts; emergency power is provided; there is no consistency in number of floors or cab height.

It should be noted, the number of towers in each grouping or type ranges from 2 to 7 with most either 2 or 3. Thus, the composite characteristic which based on this small sampling should be evaluated in that vein. Only one tower each of the SRD, WB and WRD types were surveyed and are not included in this composite listing.

Deficiencies - The major tower deficiencies can be broadly divided into eight areas or types. The following is a list of some general observations indicating the extent of the deficiencies in each of the eight areas. See Table 2 for a more detailed tabulation of tower deficiencies.

- a. None of the towers had a complete smoke detection and alarm system.
- b. About 1/2 of the towers had inadequately enclosed stairwells.
- c. About 1/2 of the towers had inadequately enclosed shafts other than stairwells.
- d. Most towers had unprotected shaft/floor penetrations.
- e. About 1/2 of the towers had excessive amounts of combustible storage materials.
- f. About 1/2 had inadequate door closers.
- g. Most towers lacked adequate first aid fire protection.
- h. About 1/3 of the towers had an inadequate emergency plan.

None of the towers complied with the requirements or alternates consistent with OSHA, NFPA, or recognized good Fire Protection Engineering practice. (i.e. all are categorized as Type C)

Recommendation Discussion

See the individual tower engineering reports in the Appendix section for recommendation details. These recommendations are divided into two groups. First are the recommendations for tower improvements necessary to bring the tower means of egress within the scope of intent of OSHA and the Life Safety Code. The second group of recommendations are of a more general nature and reflect good fire protection engineering practice. These may or may not have any direct bearing on "code" requirements.

Group I - (Numerical listing) - The general intent of these recommendations is to provide a reasonable fire and smoke safe means of egress by providing an effectively enclosed stairwell and installing an early warning smoke detection and alarm system. With the provision of these two features, a reliable emergency egress system would be provided. To achieve this goal shaft upgrading improvements must be made in all surveyed towers i.e. none of the towers has a fully satisfactory egress system.

The recommendations consist mostly of three basic types:

a. Enclosing of a stairwell including fire doors. The basic requirement is for a 1 hour construction with 3/4 hr. rated fire door. However, in some cases where it was felt additional time may be required to evacuate the tower, higher ratings are recommended. Upgrading existing stairwells is possible in most cases.

b. Sealing and/or closing openings and/or penetrations in cable, utility and elevator shafts, floors, and doors. The sealings should be equivalent to a one hour fire resistance rating.

c. The installation of an automatic fully supervised products-of combustion detection and alarm system throughout the tower. The system should include detectors in the air ducts of all air handlers which should be automatically shut down upon system actuation. The system should actuate audible alarms throughout the tower and should have fire department supervision. A standby battery power supply should be provided.

It should be noted there may be adverse effects on ventilating systems in some cases in complying with items a. and b. i.e. opening in shafts and doors are necessary for full air circulation. Any necessary changes in the air handling systems has not been considered in any of the cost estimates. This is not within the scope of this project.

Group II (Alphabetical listing) - These recommendations generally involve such things as lack of adequate fire extinguisher protection, poor housekeeping conditions, storage of excessive amounts of combustible materials and lack of or poor emergency procedures. A few instances are noted where there is a partial use of combustible interior finishing materials or insulation.

None of the recommendations in either grouping are in any special arrangement. No attempt was made to list the recommendations in order of priority, cost, importance, etc. The Group I recommendations all must be implemented if the tower emergency egress system is to be effective. The Group II recommendations are general in nature and represent good fire protection engineering practice. They should not be construed to represent all such tower deficiencies. The tower surveys are confined to life safety hazards as outlined in the Objective.

The recommendations are not presented in any great detail. The tower surveys were not of the type necessary to produce information for final bid specification package as will be necessary if the recommendations are implemented. No attempt was made to explain the reasoning as to the necessity or purpose of each recommendation. This type information is contained in the body of the report in the general hazard discussion.

Many of the towers have outside ladders, rope and sling systems, self contained breathing apparatus, etc. for use in any emergency. None of these devices are recognized in "codes" as an aid for a secondary means of egress. The engineer does not feel these are acceptable escape means or devices due to:

- a. Apparent unwillingness of most controllers to use them.
- b. Lack of any training in their use makes the effectiveness poor.
- c. Adverse weather conditions can make them completely ineffective.
- d. Their accessibility in many cases is most difficult.

As a consequence these devices have not been considered in formulating the recommendations. If all the recommendations are implemented, alternate devices are not required or if already available, provide any additional degree of safety in the tower egress system. If the tower egress system is not improved in line with the recommendations, the devices could conceivably provide some degree of additional protection. The amount is problematical.

If it is elected by the FAA to keep these devices, the ultimate user must be trained in their use if they are to be of any value. The ladder systems should be at least upgraded to industrial ladder standards such as OSHA. None of the surveyed ladder systems met these minimum requirements. Hand rails or other such equipment needs to be considered for access to the ladders where for instance it may be necessary to walk over icy roofs and/or be exposed to strong winds.

Cost Analysis

The following is a compilation of the estimated costs necessary to implement the three categories (a, b, c) of general recommendations discussed in the beginning of the "Recommendation Discussion" section. The costs are an average of the applicable items from the tower engineering surveys grouped by the type of tower. In some instances, it is difficult to separate stairwell and shaft upgrading costs on account of over lapping areas. Thus, the cost breakdown is not precise in all instances. The costs for the Southern Region Design (SRD), Welton Becket (WB) Western Region Design (WRD) are based on a single tower survey for each type. There is a wide range of costs by tower type in some instances thus the type average may be misleading. The small sampling with most types may not lend itself to any meaningful extrapolation.

TOWER DESIGN	(a) Stairwells	(b) Shafts	(c) Detection	Total
Avco	\$ 1,165	\$ 1,140	\$ 3,000	\$ 5,305
Air-A-Plane	None	1,000	5,200	6,200
Hunt	1,500	1,250	3,450	6,200
Mock	1,680	10,000	4,880	16,560
Non FAA	9,440	800	5,700	15,940
Type O	nil	420	5,800	6,220
Pei	1,700	500	10,500	12,700
Southern Region	2,000	250	3,600	5,850
W. Becket	6,000	500	8,000	14,500
Western Region	nil	1,500	4,500	6,000
TOTAL	\$23,480	\$17,360	\$ 54,630	\$95,475
Avg-Avg	\$ 2,348	\$ 1,736	\$ 5,463	\$ 9,948

Appendix

The appendix contains the Fire Protection Engineering Reports for 27 ATC towers. The following index page is a list of all these surveyed towers. The towers are tabulated by an arbitrary numbering system, location and type of tower. The tower engineering reports are arranged in numerical order.

The cost estimates given on the last page of each report are the budgetary type and should not be construed to be actual construction estimates. Due to lack of construction detail plans, in some case only rough estimates can be made. However, the costs are sound estimates and are a valid basis for cost comparison purposes. Costs are based on indices as of the Fall of 1976. Costs are given for priority (Group I) recommendations only, i.e. none for the advisory (Group II) recommendations.

FAA - ATCT
TOWER REPORT INDEX

<u>NUMBER</u>	<u>LOCATION</u>	<u>PAGE</u>	<u>NUMBER</u>	<u>LOCATION</u>	<u>PAGE</u>
1-A	Kansas City	31	15-NF	Baltimore	120
2-A	Kinston	37	16-NF	Boston	126
			17-NF	Chantilly (Dulles)	131
3-AP	Columbus	43	18-NF	Kansas City	137
4-AP	Owensboro	49	19-NF	Milwaukee	143
5-AP	Parkersburg	55	20-0	Lancaster	149
			21-0	Muskegon	155
6-H	Grand Is.	61	22-0	San Diego	166
7-H	Warwick	67			
			23-P	Louisville	168
8-M	Bakersfield	72	24-P	Washington, DC (Andrews AFB)	174
9-M	Boise	81			
10-M	Evansville	88	25-SRD	Miami	181
11-M	Fayetteville	94			
12-M	Greensboro	101	26-WB	Dallas-Ft. Worth	187
13-M	Lincoln	108			
14-M	Portland	114	27-WRD	San Jose	194

NOTE: A = AVCO
 AP = Air-A-Plane
 H = HUNT
 M = MOCK
 NF = NON FAA
 O = Type O
 P = PEI
 SRD = Southern Region Design
 WB = Welton Becket
 WRD = Western Region Design

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 1-A (Avco)

LOCATION: KANSAS CITY, KANSAS - FAIRFAX MUNICIPAL

SURVEY DATE: JUNE 21, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED - GARY W. TUCKER - TOWER CHIEF

CONCLUSIONS

The tower has a noncombustible not fully enclosed stairwell system. Under fire and smoke conditions, the stairway facilities would be rendered untenable. By sealing or enclosing the openings in the chases and in some walls, enclosing the cab staircase and providing an early warning products of combustion detection and alarm system would make the emergency egress adequate under most fire and smoke conditions.

RECOMMENDATIONS

1. a) A complete 1 hour fire rated equivalent wall should be provided on the first floor between the equipment room and the elevator shaft. This would completely enclose the elevator shaft.
b) Enclose the cab staircase and its accessway to the tower stairwell. The enclosure including the access doors should be equivalent to a 1 hour fire rated assembly.
2. Cable and plumbing shafts or chases should be completely enclosed (1 hr. equivalent) on all floor levels. Holes or entrances to floor areas should be fire and smoke sealed. The plumbing shaft is apparently not sealed on the first and Cab levels. The cable chase has unsealed openings on the 1st and 2nd levels and possibly to the Cab.
3. A products of combustion detection and alarm system should be installed throughout the tower including all shafts.

The following items are desirable for fire-safety protection but are not considered as essential to the overall emergency egress program.

- A. A Class A fire extinguisher (equivalent to a 2-1/2 gallon water unit) should be provided on all of the first four floors and the Cab.
- B. A battery rack assembly on the first floor is unsecured and possibly could be toppled. In addition, combustible materials are stored underneath the battery rack offering possible ignition source from spilled acid. Adequate segregated storage for these combustible materials should be provided. The battery assembly should be secured and anchored to prevent damage.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became operational on June 30, 1975 and is located on "bottom land" between the Missouri River on 3 sides and higher ground to the west. The tower is located adjacent to the Terminal complex area which was built in 1929 and is a masonry constructed building located 100 feet from the tower. However, the terminal operations have ceased and the building is used primarily for office occupancies. The airport is used for private aircraft only, i.e. there are no air carriers. Air freight for automotive assembly equipment is a big traffic factor. There are visual flight controls for about a five mile radius of the tower, Level 1 facility. The area could be subject to some flooding, however, with the flood control projects established in the last years, this is not a probability. The area could also be subject to high wind conditions particularly lightning storms and tornados.

Fire Fighting Services

The entire airport facility is located within the corporate limits of Kansas City, Kansas and receives full public protection. There is a city fire station some 1,000 feet north. This station has received special training for airport crash duty.

Hours of Operation and Personnel Loading

The tower is operational 16 hours a day from 6 AM to 10 PM. Administrative activities are from about 8 AM to 4:30 PM. There is a total employment of about 8 controllers plus the chief. There are two controllers on duty during all operational hours.

Self Inspection

A thorough fire-safety inspection is made semi-annually by the Tower Chief. This is a complete tower inspection including fire, safety, housekeeping, etc. Fire extinguishers are serviced and recharged if required on an annual basis. An AF Technician checks the fire extinguishers on a monthly basis. Due to the small size of the facility and limited personnel, more elaborate procedures are not needed.

Emergency Procedures

Procedures have been established for use in all types of emergencies. These cover most natural occurrences in addition to fire related malfunctions.

Security

The main entrance door at the ground level is kept locked at all times. It is also now the practice to keep all internal doors locked. Proper identification is required before being admitted to the tower. The entire tower and terminal building area is completely open to the public. There is no security fencing on the street side of the terminal which includes the tower area. The local police department would patrol the airport area. There are no police personnel stationed at the airport.

CONSTRUCTION

General Description

The tower is of the AVCO design and includes five stories plus the Cab. The main tower is a square configuration with the hexagon shaped cab on top. The gross floor area for levels one through five is 305 sq.ft. and the Cab has 225 sq.ft. The tower is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are poured concrete on steel pans and the Cab roof consists of a steel deck and also has metal flooring. The exterior walls are steel panels of an insulated sandwich construction. Cab walls are mostly tempered glass and remainder is steel. Interior partitions are all metal. Ceilings are open on all floors except the fifth and Cab which have suspended ceilings. The Cab also has a raised floor.

Horizontal and Vertical Separation

Each of floors 1-5 consists of about 55% occupied area and the remainder consisting of the stairwell and elevator shaft areas. Entrance to the stairwell landing and/or elevator lobby area from the occupied area is through a hollow metal door with no fire rating. The cab level is a common fire area with the 5th floor Junction Room having a separate open staircase between these two floor areas. The tower stairwell ends at the Junction Floor level. The occupied areas are undivided having no partitions on any floor. The stairwell and elevator shafts are of all steel construction, unprotected throughout. The shaft enclosures are formed by the building exterior walls on two sides and the other two are of metal panels with the exception of the stairwell which is completely open on the entrance side.

Vertical Shafts

(For stairwell and elevator discussion, see the preceding section). The tower has two shafts or chases. One is primarily for open electrical signal wiring and cables and the second is for plumbing and reportedly the power lines in conduit. However, this latter point cannot be verified. Both shafts are all metal construction completely open from the first through the 5th floors, i.e. no fire stops. The plumbing chase is within and part of the construction of the elevator shaft. The electrical chase is separate all steel enclosure within the occupied sections of the floors. The electrical chase has unsealed openings into floors one and two. The chase is probably open into the Cab area but this could not be seen. The plumbing shaft is completely sealed with no unprotected openings on floors 2 through 5. However, it is reportedly open on the first and Cab floor levels.

Interior Finishes

There are no unacceptable interior finishes. All the floors having vinyl tile covering except the Cab floor is carpeted. Suspended ceilings are provided on the 5th and Cab levels, consisting of mineral acoustic tiles in metal frames. The fire characteristics of these materials is unknown.

UTILITIES

HVAC

Heating and air conditioning is provided by combination wall type Singer units. These take fresh air through a wall opening and circulate directly into the room of occupancy. There is no ducting used for circulating the conditioned air. These units are provided on the second, third and fourth floors only. The cab level has its own heating and cooling unit located on the roof and would also supply the Junction Room on the fifth floor from natural circulation. Electric space heaters are provided on the first and fifth floors as well as the stairwell. The Singer units are 208 volt and in the range of 1-1/2 T capacity each.

Electrical

Electrical power is purchased from the Board of Public Utilities of Wyandotte County. There is no transforming, current is supplied at 208 volts to the first floor main distribution panel for use throughout the tower at 208 or 110 volts. The higher voltage is used in the air conditioning units and the elevator hoist motor. The tower radio equipment is DC operating off an inverter with storage batteries for use in an emergency case of power failure. There have been two power failures of about one hour each since the opening of the tower. There is no emergency power generation on the premises. Electrical power after entering on the first floor is transmitted to other levels through the plumbing chase in conduit. (See Vertical Shafts)

Fire Protection Water Supply

There is no in tower fire water system. Fire water is supplied by the city distribution system. Hydrants are located along Fairfax Road.

EXITING FACILITIES

There are two normal egress methods, the stairwell or the elevator. The Cab floor level is 54 feet above grade thus making the elevator the preferred exiting method from most levels. In an emergency there is also available an outside ladder with access from the Cab level only. The ladder goes from the cab floor level to within 8 feet of the ground. This system could be unusable in adverse weather conditions, for instance ice. The fifth floor stairwell-elevator lobby is accessible from the cab only through the Junction Room. There are no exit marking systems used.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire equipment only, consisting of 15 lb. CO₂ units provided on all floor levels. There are no Class A type extinguishers provided for any of the office type occupancies.

Detection and Alarm Systems

None. Public fire fighting facilities could be summoned by a direct telephone hot line provided in the Cab. The tower is unattended 8 hours per day.

Automatic Extinguishing Systems

None

OCCUPANCY

The occupancies are typical of a moderate sized tower and consist of:

First Floor (165 sq.ft. net floor area - ground level):
Consists of the equipment room containing the elevator hoist equipment, main electrical distribution panel, battery racks, inverter assembly and telephone equipment panel.

Second Floor (165 sq.ft. net floor area - floor elevation 10'): Maintenance shop facilities and equipment and the radio receiver distribution cabinet.

Third Floor (165 sq.ft. net floor area - floor elevation 20'): Consists entirely of the Tower Chief's office.

Fourth Floor (165 sq.ft. net floor area - floor elevation 30'): Consists of the training room, furniture and fixtures, a convenience unit including a microwave oven, file drawers, metal lockers, tables and chairs. No cooking is done with any of the convenience equipment.

Fifth Floor (133 sq.ft. net floor area - floor elevation 40'): Consists of the Junction Room containing radio relay panels, voice recording equipment, multichannel recorder, cable trays with distribution to the Cab level, Telco panel, AC and DC electrical panels and a small water closet is also included.

Cab Level (110 sq.ft. net floor area - floor elevation 54'): This is a visual flight control Cab with one radar unit. There is also a convenience unit provided for personnel. (No cooking).

Costs for Implementation

of Recommendations

No. 1-A

1. \$1500.
2. \$1000.
3. \$3000.

TOTAL \$5500

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 2-A (Avco)

LOCATION: KINSTON, NORTH CAROLINA - STALLINGS FIELD

SURVEY DATE: JUNE 17, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: GERALD L. NORRIS - TOWER CHIEF
BOB NIELSEN - A.F. TECHNICIAN

CONCLUSIONS

The tower has a noncombustible not fully enclosed fire escape means. Under fire and smoke conditions the facilities would be rendered untenable. Sealing or enclosing openings in the chases and walls, enclosing the cab staircase and providing an early warning products of combustion detection and alarm system would make the emergency egress adequate under most fire and smoke conditions.

RECOMMENDATIONS

1. a) A complete 1 hour fire rated equivalent wall should be provided on a first floor between the equipment room and the elevator shaft. This would completely enclose the elevator shaft.
1. b) Enclose the cab staircase and its access-way to the tower stairwell. The enclosure including the access doors should be equivalent to a 1 hour fire rated assembly.
2. Cable and plumbing shafts should be completely enclosed (1 hr. fire rated equivalent) on all levels. Any wiring, conduit, piping, etc. holes or entrances at floor levels should be fully fire and smoke sealed.
3. A products of combustion detection and alarm system should be installed throughout the tower including all shafts.
4. Procedures should be established to make certain that all doors opening onto the stairwell be kept closed at all times. During the survey, some doors were found to be held open.

The following items are desirable for improving fire-life safety protection, but are not considered essential to the overall emergency egress program.

- A. A class A fire extinguisher (equivalent to 2-1/2 gallon water unit) should be provided on all levels.
- B. Combustible materials are being stored in the equipment room of the first floor. This type of material should be stored in areas suitable for combustibles, where it does not expose valued equipment.

C. Decals or other types of indicators should be provided on or near all telephones. These should list the appropriate local emergency call numbers.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower was commissioned on April 11, 1975, and is located on gently rolling terrain. The tower is located adjacent to the terminal area and in a complex of noncombustible buildings at a distance of 100' or more, all part of a former air force base site. These buildings are to be razed for airport expansion and modernization. The area would be subject to severe windstorms of hurricane proportion since it is located in the general east coast hurricane belt. However, general weather conditions are moderate.

Fire Fighting Services

The tower and entire airport facility are located in county area however, adjacent to the limits of the city. The airport is a joint city and county venture. There are both city and county fire stations available, one each being within 3 miles.

Hours of Operation and Personnel Loading

The tower is operational from 12 noon to 8 pm daily, however this is to be expanded to 6 am to 10 pm. Administrative facilities are open from 8:30 am to 5:00 pm. There is a total employment of around 10. The normal tower load is 5 in the Cab, 2 to 3 on the third floor and 1 on the fourth. There are at least 2 controllers on duty at all times, while operational.

Self Inspection

A thorough inspection is made semi-annually. This is a complete tower inspection including fire, safety, housekeeping, etc. The fire extinguishers are serviced and recharged if required on an annual basis.

An A.F. Technician checks the fire extinguishers monthly on a routine basis. Due to the small size of the facility and limited personnel, more elaborate procedures are not required.

Emergency Procedures

Written procedures have been established for use in all types of emergencies. These cover most natural occurrences in addition to fire related malfunctions.

Security

The main level entrance door is kept locked at all times. Proper identification is required before being admitted to the tower. The entire airport terminal area is completely open to the public and there is no security fencing on the arrival side of the terminal which includes the tower area. The sheriff's department patrols the airport area although there is no station at the airport. The sheriff also provides the boarding security check at the terminal.

CONSTRUCTION

General Description

The tower is of the AVCO design and includes five stories plus the Cab. The main tower is a square configuration with a hexagon shaped Cab on top. The gross floor area for levels 1 through 5 is 305 sq. ft. and the Cab has 225 sq.ft. The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are poured concrete on steel pans and the Cab roof consists of a steel deck and also has a metal flooring. Exterior walls are apparently steel panels of an insulated sandwich construction. The cab walls are mostly tempered glass and the remainder steel. Interior partitions are hollow metal panelling. Ceilings are open on all floors, the Cab however has a suspended ceiling and raised floor with concealed spaces above and below respectively.

Horizontal and Vertical Separation

Each of the 1st to 5th floors consists of 1/2 occupancy area and the other half consisting of the stairwell and elevator shaft. Entrance to the stairwell landing or elevator lobby from the occupied area is through a hollow metal door with no fire rating. That is, not listed by a recognized testing laboratory. The Cab level is a common fire area with the 5th floor Junction Room having a separate open staircase between the Cab level and 5th floor, i.e., the tower stairwell ends at the Junction level. The occupied areas are undivided(no partitions) on all floors. The stairwell and elevator shafts are of all steel construction unprotected throughout. These enclosures are formed by the building exterior walls on two sides and the other two sides are hollow metal panels with the exception of the stairwell which is completely open on the entrance side.

Vertical Shafts

(For stairwell and elevator discussion, see the preceding section.) The tower has two shafts or chases. One is primarily for open PVC insulated electrical signal wiring and cables and the second is for utility piping and power lines in conduit. Both shafts are all metal construction, completely open from the first to the fifth floor. The utility chase is within and part of the construction of the elevator shaft. The electrical chase is a separate all metal enclosure within the occupied sections of the floors. The electrical chase has unsealed openings on all floor levels. The utility shaft is completely sealed with no unprotected openings on 2nd, 3rd and 4th levels. However, the shaft is open on the 1st, 5th and Cab levels.

Interior Finishes

There are no unacceptable interior finishes, only the floors have any finishing material. These consist of carpeting, vinyl tile and a small amount of wood. The Cab suspended ceiling consists of mineral lay-in tiles on steel frames. The fire characteristics of the materials are unknown.

UTILITIES

HVAC

Heating is provided by a combination heating and air conditioning unit, window type, however with a wall fresh air intake. These units are provided on the third and fourth floors only and are 1-1-1/2 Tons capacity each. There is no duct work for these units as they blow conditioned air directly into the room of occupancy. The Cab level has its separate air conditioning unit located on the roof of the Cab and supplies conditioned air primarily to the Cab with whatever spillover is available to the Junction Room.

Electrical

Electrical power is purchased from the Public Works Department of the City of Kinston. The city, however, has no electrical generating facilities and purchases their supply (for resale) from the Carolina Power and Light Company. Electricity is received at 208 volts and there is no transforming done on the premises. The general use of the tower is 208 and 100 volts. The 208 voltage is used for the air conditioning units and the elevator hoist motor. The 110 voltage is utilized in all other areas. Tower radio equipment operates on DC power through an inverter in normal operations. There is no emergency power generation. The approach control equipment can be operated from a standby rack of batteries. Electric power enters on the first floor through the main electrical distribution panel and is transmitted to other levels through the electrical chase. (See vertical shafts).

Fire Protection Water Supply

There is no in tower fire water system. Fire water protection is apparently supplied off the city water distribution system. There are two hydrants in the vicinity of the tower.

EXITING FACILITIES

The normal method of egress is the elevator. The stairwell would also be available, however, the Cab level is 54' above grade, thus making the elevator the preferred method from all levels. In an emergency, there is also available an outside ladder with access from the Cab level only. The ladder goes from the Cab floor to within 8 feet of the ground. This system could be unusable under adverse weather conditions. The fifth floor stairwell-elevator lobby is accessible from the Cab only through the Junction Room on the fifth floor. The combined elevator lobby-stair landing areas are adequately cut off on all floor levels by a single hollow metal door not fire rated. There is no exit signing. There is no provision for alternate power in case of an outage. Battery operated lights are provided in the stairwell.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of 15 lb. CO₂ units which are provided on the 1st, 2nd, 5th and Cab levels

only, i.e. 3rd and 4th levels have no extinguishers. There are no Class A units provided. Fire extinguishers are inspection monthly and receive an annual full maintenance inspection and servicing.

Detection and Alarm Systems

None. City and County fire department would be summoned by the use of the public telephone system. There is no formal in house procedure established for alerting personnel to an emergency.

Automatic Extinguishing Systems

None.

OCCUPANCY

The occupancies are typical of a small tower and consist of:

First Floor (160 sq.ft. net floor area - ground level):

Equipment room containing elevator hoist equipment, main electrical distribution panel, battery racks and inverter assembly and misc. combustible box storage.

Second Floor: (175 sq.ft. net floor area - floor elevation 10'): Small maintenance shop with steel storage cabinets.

Third Floor: (175 sq.ft. net floor area - floor elevation 20'): An office occupancy consisting of the Ready/Training and secretarial areas.

Fourth Floor: (175 sq.ft. net floor area - floor elevation 30'): The Tower Chief's office.

Fifth Floor: (145 sq.ft. net floor area - floor elevation 40'): The Junction Room containing the radio transmitter, receiver and tape recorder racks, AC and DC electrical panels and the TELCO demarcation box. A small water closet is also included.

Cab Level: (200 sq.ft. net floor area - floor elevation 54'): A visual flight control Cab (no radar). There is also a convenience unit provided for personnel consisting of a microwave oven, stove, sink, hot plates, etc. No cooking is done.

**Costs for Implementation
of Recommendations**

No. 2-A

1.	\$1500
2.	\$1000
3.	\$3000
4.	<u>None</u>
TOTAL	\$5500

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 3-AP (Air-A-Plane)

LOCATION: COLUMBUS, OHIO - OHIO STATE UNIVERSITY AIRPORT

SURVEY DATE: AUGUST 4, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. GEORGE ACRES - TOWER CHIEF

CONCLUSIONS

The tower has a noncombustible and effectively enclosed stairwell. However, under fire and smoke conditions, the stairwell would be rendered untenable. The provision of smoke tight shaft facilities and a complete products of combustion detection and alarm system would make for an adequate emergency egress system.

RECOMMENDATIONS

1. The top of the elevator shaft should be completely enclosed in manner to be smoke tight and provide the equivalent of a 1 hour fire rating.
2. An automatic products of combustion detection and alarm system should be installed throughout the tower. The system should have automatic alarm supervision by the Airport Fire Department. Circuitry supervision and a standby power supply should be provided on the system.
3. All cable openings in the cab floor should be sealed with noncombustible materials and covered with asbestos cement board.
4. All polyurethane on the underside of the cab floor should be removed. If insulation is needed, a noncombustible material should be substituted.

The following items are desirable for improving fire-life safety protection but are not considered essential to the over-all emergency egress program.

- A. Class A type fire extinguishers (equivalent to 2-1/2 gal. water unit) should be provided throughout the tower.

B. Combustible storage materials should be removed from the two ventilation rooms and on the stairway landings.

C. All telephones should have emergency call numbers listed.

D. The 5 gal. hydraulic oil can on the first floor should be placed in a safety can.

GENERAL ASPECTS

Site Features, Conditions and Exposures

Ohio State University owns the entire airport facility consisting of 1400 acres. There are no commercial flights out of the airport with mostly private flights; however, some small business planes are also based here. The tower became operational in 1972 and is located approximately 1/2 mile from the main building and former tower. The runways are in front of the tower but not exposed by them. No radar is used in the tower. The area is not normally subject to any unusually severe climatic condition. A small metal aircraft hangar is located about 100 ft. from the tower. There are no other structures in the immediate area. However, the general area is used to park private planes. The tower is equipped with lightning protection and has been hit; however no equipment has been affected.

Fire Fighting Services

The tower and airport facility is located within the limits of the City of Columbus, Ohio. The airport fire station is located 1/3 mile from the tower. This station is manned 24 hours a day. Initial response is a foam truck with light water and an engine company. Mutual aid response is from a fully paid fire department which responds with a medical unit, a 1000 gpm pumper, a 100 ft. aerial ladder and five men. Each man has an air pack. Response time is around 5 minutes. The airport fire station does not have a ladder capable of reaching the cab.

Hours of Operation and Personnel Loading

The tower is operational from 7 am to 11 pm with a maximum of 5 in the cab, the minimum is 2. The number of personnel below the cab level ranges from none to 2, depending on time of day.

Self Inspection

There is no formal self-inspection program of significance. The tower chief inspects the fire extinguishers on a regular basis. The fire department also inspects the tower. Due to the small size of the facility and limited personnel, more elaborate procedures are not required.

Emergency Procedures

Written procedures have been established for use in some emergency situations but are not posted. No procedures have been established for fire emergencies.

the condensers located on the roof outside the cab) supply the sixth level. These use electric heating units. Maximum heating capacity of a unit is 82,000 Btu/hr. and maximum cooling is 69,000 Btu/hr. No conditioned air is supplied to the lower levels.

Electrical

Electric power is purchased from the local power company. Power is received at 208/110 volts from transformers located on the utility companies pole. System power is three phase, four wire with the meter and main breaker located on the utility pole. Four in tower distribution panels are provided.

There is no emergency generator at this facility and operations are restricted to the capabilities of standby batteries. All power circuits are in conduit. Standby batteries will last approximately 3 hours. The entire tower is protected by battery powered emergency lights. There are no exit signs in the tower and none is needed.

Fire Protection Water Supply

The tower has no fire water protection. There are no fire hydrants in the area. Well water supplies domestic needs.

EXITING FACILITIES

The stairway is the only recognized means of egress from the tower. It is a completely open shaft from the ground level to the cab. There are no fire rated cut-offs at various levels. There is a folding ladder in the cab for access to the roof. There is a hatch from the 6th floor to the roof. The escape hatch is of limited value as access to it is through the sixth floor lounge and equipment rooms. There is no outside ladder. An elevator is provided.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only, consisting of 15 lb. CO₂ and 10 lb. dry chemical fire extinguishers. There are no extinguishers suitable for Class A fires.

Detection and Alarm Systems

The airport fire station (on the airport property) is manned 24 hrs. a day. A red phone and a direct line is provided to the airport fire station from the cab. The fire department can also be reached by dialing 51 on any other telephone. There are no detection systems.

Automatic Extinguishing Systems

None.

Security

A fence encloses the airport with a separate fenced gate for the tower. An intercom system at the tower door is provided for proper identification. An electric strike, activated in the cab, is provided for the door release and access to the tower. Ohio State University police patrol the airport on a regular basis.

CONSTRUCTION

General Description

The tower is an Air-A-Plane type with 6 levels and cab. Floors 1-5 consist of the elevator and stairway only and are about 12' x 12'. The sixth floor is about 24' x 24' and consists of the equipment room, toilet, lounge, two equipment rooms, and the tower chief's office. The cab is located on the roof of the sixth floor.

The building is of noncombustible construction. (NFPA 220) The structural frame is unprotected steel, floors are lightweight concrete on steel decking, walls are steel sandwich panels with polyurethane insulation and the roof is insulated steel decking with a built-up covering. The stairway is steel. Interior partitions on the 6th floor are metal insulated sandwich panels to the suspended ceiling only.

Horizontal and Vertical Fire Separation

The elevator which runs from the ground floor to the fifth has metal insulated panel sandwich walls with a 1-1/2 hr. Class B fire doors. The elevator shaft is open at the top. The partitions on the sixth floor have openings with wood louvered doors. There are numerous penetrations through the floor of the cab. The tower is basically one large open shaft including the cab area.

Vertical Shafts

All power and communication cables are run in rigid conduit in the stairway. The elevator shaft, with openings on floors 1 and 5, terminates on the fifth floor.

Interior Finishes

Open wall finish is provided on the first five levels. Floors have carpeting or vinyl asbestos tile on the fifth and cab levels. These areas also have suspended ceilings. Wood paneling covers the walls of the tower chief's room.

UTILITIES

HVAC

Heating in the stairway is provided by small 220 volt electric unit heaters located against the outside wall. The cab has a combination air conditioning-heating unit on the roof which only serves the cab. Two combination heating and cooling units (with

OCCUPANCY

Occupancies for the various levels consist of the following:

1st Floor: Elevator opening, stairway, motor and controls for hydraulic elevator.

2nd Floor: Stairway

3rd Floor: Stairway

4th Floor: Stairway

5th Floor: Elevator opening, stairway

6th Floor: Equipment room, toilet, tower chief's office, lounge, two ventilation rooms.

Cab Level: Approximately 60 ft. above grade.

Costs for Implementation

of Recommendations

No. 3AP

1. \$ 700.

2. \$5,200.

3. \$ 300.

4. \$ 700.

TOTAL \$6,900.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 4-AP (Air-A-Plane)

LOCATION: OWNESBORO, KY - OWENSBORO - DAVIESS COUNTY AIRPORT

SURVEY DATE: AUGUST 5, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. THOMAS GAETY - TOWER CHIEF

CONCLUSIONS

The tower has a noncombustible and effectively enclosed stairwell. However, under fire and smoke conditions the stairwell would be rendered untenable. The provision of smoke tight shaft facilities and a complete products of combustion detection and alarm system would make for an adequate emergency egress system.

RECOMMENDATIONS

1. The top of the elevator shaft should be completely enclosed in manner to be smoke tight and provide the equivalent of a 1 hour fire rating.
2. An automatic products of combustion detection and alarm system should be installed throughout the tower. The system should have automatic alarm supervision by the fire department. Circuitry supervision and a standby power supply should be provided on the system.
3. All cable openings in the cab floor should be sealed with noncombustible materials and covered with asbestos cement board.
4. All polyurethane on the underside of the cab floor should be removed. If insulation is needed, noncombustible material should be substituted.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. Class A type fire extinguishers (equivalent to 2-1/2 gal water unit) should be provided throughout the tower.

- B. All combustible storage materials should be removed from the stairway and ventilation rooms.
- C. All telephones should have emergency call numbers listed.
- D. The hydraulic oil and rags should be removed from the elevator pit.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This level I tower which became operational in 1970 is located approximately 70 ft. from the main terminal. The runways are in front of the tower but not exposed by them. No radar is used in the tower. The area is not subject to any unusually severe climatic condition except for an occasional high wind. There is no other structure in the immediate area. The tower is equipped with lightning protection.

Fire Fighting Services

The tower and airport facilities are located in Owens and Daviess County with the airport fire station located 1/4 mile from the tower. The station is manned 24 hours a day with a normal work force of 3 firemen. Air packs are provided for all men at the station. Equipment at the station includes a crash truck, 1000 gpm pumper with a 750 gal. tank, and a 750 gpm pumper with a 850 gal. tank. The largest ladder from the fire department is 40 ft. which would not reach the cab. Additional response from other city stations and would take approximately 5 minutes running time.

Hours of Operation and Personnel Loading

The tower is operational from 6 a.m. to 10 p.m. with the maximum number of personnel in the cab is 5 and the minimum is 2. Personnel occupancy below the cab level ranges from none to two.

Self Inspection

There is no formal self-inspection program of significance. Maintenance inspects the fire extinguishers on a regular basis. The fire department also inspects the tower. Due to the small size of the facility and limited personnel, more elaborate procedures are not required.

Emergency Procedures

Written procedures have been established for use in some emergency situations but are not posted. No procedures have been established for fire emergencies.

Security

There is no fence around the tower and it is completely open to the public. An intercom system is provided at the tower entrance door for proper identification. An electric release is provided.

CONSTRUCTION

General Description

The tower is an Air-A-Plane type with 6 levels and cab. Floors 1-5 consist of the elevator and stairway only and are about 12' x 12'. The sixth floor is about 24' x 24' and consists of the equipment room, toilet, lounge, two equipment rooms and the tower chief's office. The cab is located on the roof of the sixth floor.

The building is of noncombustible construction. (NFPA 220). The structural frame is unprotected steel, floors are lightweight concrete on steel decking, walls are steel sandwich panels with polyurethane insulated steel decking with a built-up covering. The stairway is steel. Interior partitions on the 6th floor are metal insulated sandwich panels to the suspended ceiling only.

Horizontal and Vertical Fire Separation

The elevator which runs from the ground floor to the fifth has metal insulated panel sandwich walls with a 1-1/2 hr. Class B fire doors. The elevator shaft is open at the top. The partitions on the sixth floor have openings with wood louvered doors. There are numerous penetrations through the floor of the cab. The tower is basically one large open shaft including the cab area.

Vertical Shafts

All power and communication cables are run in rigid conduit in the stairway. The elevator shaft, with openings on floors 1 and 5, terminates on the fifth floor.

Interior Finishes

Open wall finish is provided on the first five levels. Floors have carpeting or vinyl asbestos tile on the sixth and cab levels. These areas also have suspended ceilings. Wood paneling covers the walls of the tower chief's room.

UTILITIES

HVAC

Heating in the stairway is provided by small 220 volt electric unit heaters located against the outside wall. The cab has a combination air conditioning-heating unit on the roof which only serves the cab. Two combination heating and cooling units (with the condensers located on the roof outside the cab level) supply the sixth level. These use electric heating units. Maximum heating of a unit is 82,000 Btu/hr. and maximum cooling is 69,000 Btu/hr. No conditioned air is supplied to the lower levels.

Electrical

Electric power is purchased from the local power company. Power is received at 2160 volts, and delivered to the tower at 208/110 volts by transformers located on the utility company pole. System power is three phase, four wire with the meter and main

breaker located on the utility pole. Four in tower distribution panels are provided.

There is no emergency generator at this facility and emergency operations are restricted to the capabilities of standby batteries. All power circuits are in conduit. The entire tower is protected by battery powered emergency lights. There are no exit signs in the tower and none is needed.

Fire Protection Water Supply

There is a fire hydrant at 50 ft. on a 10" dead end main with 60 static pressure psi. Water is from the City of Owensboro distribution system.

EXISTING FACILITIES

The stairway is the only recognized means of egress from the tower. It is a completely open shaft from the ground level to the cab. There are no fire rated cut-offs at various levels. There is a folding ladder in the cab for access to the roof. There is a hatch from the 6th floor to the roof. The outside escape hatch is of limited value as access to it is through the sixth floor lounge and equipment rooms. There is no outside ladder. There is an elevator.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of 15 lb. CO₂ and 10 lb. dry chemical fire extinguishers. There are no extinguishers suitable for Class A fires.

Detection and Alarm Systems

The airport fire station has two direct lines from the cab. There are no detection systems.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies for the various levels consist of the following:

1st Floor: Elevator opening, stairway, motor and controls for hydraulic elevator.

2nd Floor: Stairway

3rd Floor: Stairway

4th Floor: Stairway

5th Floor: Elevator opening, stairway

6th Floor: Equipment room, toilet, tower chief's office, lounge,
two ventilation rooms

Cab Level: Approximately 60 ft. above grade.

**Costs for Implementation
of Recommendations**

No. 4AP

1.	\$ 700.
2.	\$5,200.
3.	\$ 300.
4.	\$ <u>700.</u>
TOTAL	\$6,900.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 5-AP (Air-A-Plane)

LOCATION: PARKERSBURG, WEST VIRGINIA
WOOD COUNTY AIRPORT

SURVEY DATE: AUGUST 3, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. SWARTZ - TOWER CHIEF

CONCLUSIONS

The tower has a noncombustible and effectively enclosed stairwell. However, under fire and smoke conditions, the stairwell would be rendered untenable. The provision of smoke tight shaft facilities and a complete products of combustion detection and alarm system would make for an adequate emergency egress system.

RECOMMENDATIONS

1. The top of the elevator shaft should be completely enclosed in manner to be smoke tight and provide the equivalent of a 1 hour fire rating.
2. An automatic products of combustion detection and alarm system should be installed throughout the tower. The system should have automatic fire department alarm supervision. Circuitry supervision and a standby power supply should be provided on the system.
3. All cable openings in the cab floor should be sealed with noncombustible materials and covered with asbestos cement board.
4. All polyurethane on the underside of the cab floor should be removed. If insulation is needed, a noncombustible material should be substituted.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. Class A type fire extinguishers (equivalent to 2-1/2 gal. water unit) should be provided throughout the tower.

B. The trailer should be relocated at least 50 ft. away from the tower.

C. All telephones should have emergency call numbers listed on them.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became operational in 1972 and is located approximately 1/4 mile from the main terminal. The runways are in front of the tower but not exposed by them. No radar is used in the tower. The area is not subject to any unusually severe climatic condition. An airways facility trailer is located adjacent to the tower. There is no other structure in the immediate area. The tower is equipped with lightning protection.

Fire Fighting Services

The tower and airport facilities are located in Wood County and within the corporate limits of Williamstown. The airport fire station is located next to the terminal building approximately 1/2 mile from the tower. The fire station has no equipment that can reach the cab level of the tower. Only two maintenance personnel who are also the firemen, man the fire station. The two pieces of equipment at the fire station consist of an engine and a foam truck. Both Waverly and Williamstown fire departments can respond within 15 min. if needed.

Hours of Operation and Personnel Loading

The tower is operational from 7 am to 11 pm. The maximum number of personnel in the cab is 5 and the minimum is 2. Personnel occupancy below the cab level ranges from none to two.

Self Inspection

There is no formal self-inspection program of significance. The tower chief inspects the fire extinguishers on a regular basis. The airport fire station personnel also inspects the tower. Due to the small size of the facility and limited personnel, more elaborate procedures are not required.

Emergency Procedures

Written procedures have been established for use in some emergency situations but are not posted. No procedures have been established for fire emergencies.

Security

A fence encloses the front of the tower only. An intercom system is provided at the tower entrance for proper identification. An electric release is provided on the entrance door.

CONSTRUCTION

General Description

The tower is an Air-A-Plane type with 6 levels and cab. Floors 1-5 contain the elevator and stairway only and are about 12 x 12. The sixth floor is about 24 x 24 and consists of the equipment room, toilet, lounge two equipment rooms, tower and the chief's office. The cab is located on the roof of the sixth floor.

The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are lightweight concrete on steel decking, walls are steel sandwich panels with polyurethane insulation and the roof is insulated steel decking with a built-up covering. The stairway is steel. Interior partitions on the 6th floor are metal insulated panels to the suspended ceiling only.

Horizontal and Vertical Fire Separation

The elevator which runs from the ground floor to the fifth has metal panel sandwich walls with 1-1/2 hr. Class B fire doors. The elevator shaft is open at the top. The partitions on the sixth floor have openings with wood louvered doors. There are numerous penetrations through the floor of the cab. The tower is basically one large open shaft including the cab area.

Vertical Shafts

All power and communication cables are run in rigid conduit in the stairway. The elevator shaft, with openings on floors 1 and 5, terminates on the fifth floor.

Interior Finishes

Open wall finish is provided on the first five levels. Floors have carpeting or vinyl asbestos tile on the sixth and cab levels. These areas also have suspended ceilings. Wood paneling covers the walls of the tower chief's room.

UTILITIES

HVAC

Heating in the stairway is provided by small 220 volt electric unit heaters located against the outside wall. The cab has a combination air conditioning-heating unit on the roof which only serves the cab. Two combination heating and cooling units (with the condensers located on the walkway outside the cab level) supply the sixth level with heating and air conditioning. These use electric heating units. Maximum heating of a unit is 82,000 Btu/hr. and maximum cooling is 69,000 Btu/hr. No conditioned air is supplied to the lower levels.

Electrical

Electric power is purchased from the local power company. Power

2nd Floor: Stairway

3rd Floor: Stairway

4th Floor: Stairway

5th Floor: Elevator opening, stairway

6th Floor: Equipment room, toilet, tower chief's office, lounge, two ventilation rooms.

Cab level: Approximately 60 ft. above grade.

Costs for Implementation

of Recommendations

No. 5AP

1.	\$ 700.
2.	\$5,200.
3.	\$ 300.
4.	\$ <u>700.</u>
TOTAL	\$6,900.

**REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS**

REPORT NO.: 6-H (Hunt)

LOCATION: GRAND ISLAND, NEBRASKA

SURVEY DATE: JUNE 23, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: BOB DUBAS - ACTING CHIEF
JACK SCHAEFFER - ELECTRONIC TECHNICIAN

CONCLUSIONS

The tower has an inadequate escape means. The stairwell is not enclosed at the cab level. The tower stairwell is moderately exposed from combustible storage in the elevator shaft areas at each level. Under severe smoke conditions, the inside facilities would be rendered untenable, as smoke tight facilities are not provided throughout. By sealing off existing openings in the chases, enclosing the cab access to the tower stairwell and providing an early warning products of combustion detection and alarm system, the emergency egress would be adequate under most fire and smoke conditions.

RECOMMENDATIONS

1. A products of combustion detection and alarm system should be installed throughout the tower including the chases and stairwell.
2. The electrical chase should be sealed and made smoke tight and fire resistant at existing openings on first and third floors. Openings into the Cab level from the electrical and plumbing chases should be sealed.
3. The folding noncombustible doors on the hoist-shaft should be replaced by 1-1/2 hr. rated fire doors.
4. Enclose the cab staircase and its accessway to the tower stairwell landing area. Provide a 1 hr. fire door for access from the Junction Room to the cab accessway.

The following items are desirable for improving fire-life safety but are not considered essential to the overall emergency egress program.

- A. A Class A fire extinguisher (equivalent to a 2-1/2 gallon water unit) should be provided on the third and cab levels.
- B. All telephones should have emergency call numbers listed in the immediate area.

GENERAL ASPECTS
Site Features, Conditions and Exposures

is received at 6600 volts, and delivered to the tower at 208/110 volts by transformers located on the utility company pole. System power is three phase, four wire with the meter and main breaker located on the first floor. Four in tower distribution panels are provided.

There is no emergency generator at this facility and emergency operations are restricted to the capabilities of standby batteries. All power circuits are in conduit. The entire tower is protected by battery powered emergency lights. There are no exit signs in the tower and none is needed.

Fire Protection Water Supply

The tower has no fire water protection. A single fire hydrant is located approximately 1/3 mile away supplied off the Waverly distribution system.

EXITING FACILITIES

The stairway is the only recognized means of egress from the tower. It is a completely open shaft from the ground to the cab. There are no fire rated cut-offs at various levels. There is a folding ladder in the cab for access to the roof. There is a hatch from the 6th floor to the roof. The outside escape hatch is of limited value since access to it is through the sixth floor lounge and equipment rooms. There is no outside ladder. There is an elevator.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of 15 lb. CO₂ and 10 lb. dry chemical fire extinguishers. There are no extinguishers suitable for a Class A fire.

Detection and Alarm Systems

None. The airport fire department is called by the remote activation of a siren at the fire station. The tower also has a radio transmitter that can summon Waverly and/or Williamstown fire departments. These two departments can also be summoned by the use of private telephones.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies for the various levels consist of the following:

1st Floor: Elevator opening, stairway, motor and controls for hydraulic elevator.

The tower became operational in October, 1973 and is located in flat prairie country in southeastern Nebraska. The tower is located adjacent to the Terminal Building. The airport has Level 1 activity. There are 8 Frontier airlines flights per day, the only air carrier. There is visual flight controls for about a five mile radius of the tower with radio control to about 20 miles. There are no radar facilities at the tower. The area could be subject to severe wind conditions, particularly tornados principally in the spring of the year.

Fire Fighting Services

The entire airport facility is located about one mile beyond the corporate limits of Grand Island in Hall County, the owner, operating through an Airport Authority. There is a small airport fire station which is attended by one man only when there is air carrier traffic. At other times, response is from an in town station with running time of about 10 minutes.

Hours of Operation and Personnel Loading

The tower is operational from 8:00 AM to 12:00 midnight with a total of 80,000 operations per year. The total number of employees is about 10. Maximum number on duty is during the daytime when there are three in the Cab plus the tower Chief. The minimum number on duty is two controllers both in the Cab.

Self Inspection

A thorough fire-safety inspection is made semi-annually by regional FAA personnel. This is a complete tower inspection including, fire, safety, housekeeping, etc. An AF Technician checks fire extinguishers on a monthly basis. Fire extinguishers are serviced and recharged if necessary on an annual basis. Due to the small size of the facility and limited personnel, more elaborate procedures are not needed.

Security

The main entrance door at ground level is kept locked at all times. Proper identification is required before being admitted to the tower. The entire tower and terminal building area is completely open to the public. There is no security fencing on the access side of the terminal which includes the tower area. The sheriff's department is responsible for police protection at the airport, however there is no permanent personnel stationed at the airport and no scheduled patrolling. A sheriff's officer provides the passenger gate security checking.

CONSTRUCTION

General Description

The tower is of the Hunt design and includes three stories plus the Cab. The main tower is a square configuration with a hexagon shaped Cab on top. The gross floor area for levels 1-3 is 305

sq.ft. and the Cab has 225 sq.ft. The building is of noncombustible construction (NFPA) 220. The structural frame is unprotected steel, floors are poured concrete on steel pans and the Cab has steel deck roof and flooring. The exterior walls are steel panels of an insulated sandwich construction. Cab walls are mostly tempered glass and remainder is steel. Interior partitions are all metal. Ceilings are mostly open with exception of the Chief's office and the Cab. The Cab also has a raised floor.

The stairwell and elevator shafts are all steel construction unprotected throughout. There is no elevator, however, and the shaft area is used as storage rooms or areas. The shaft enclosures are formed by the building exterior walls on two sides and the other two are interior metal panel partitions with the exception of the stairwell which is completely open on the entrance side.

Horizontal and Vertical Separation

Each of the first three floors consists of about 55% occupied area and the remainder consisting of the stairwell and elevator shaft areas. Entrance to the stairwell landing and/or elevator lobby area from the occupied area is through a hollow metal door with no fire rating. The Cab level is a common fire area with the 5th floor Junction Room having a separate open staircase between the two floor areas. The tower stairwell ends at the junction floor level (3rd). The occupied areas are undivided having no partitions on any of the floors. Ordinary metal folding doors are provided on the elev. shaft.

Vertical Shafts

(For stairwell and elevator shaft discussion, see the preceeding section).

The tower has two shafts or chases. One is primarily for open electrical signal wiring and cables and the second is for plumbing and power lines in conduit. Both shafts are all metal construction completely open from the first through the top level, i.e. no fire stops. Plumbing chase is within and part of the construction of the elevator shaft. The electrical chase is separate all steel enclosures within the occupied sections of each floor. The electrical chase has unsealed openings into the occupied areas of the floors 1 and 3 and probably the Cab, however this could not be definitely ascertained. The plumbing chase is completely sealed with no unprotected openings on any floor except the Cab level where it is reportedly open.

Interior Finishes

There are no unacceptable interior finishes. All the floors have vinyl tile covering except for the chief's office and the cab which are carpeted. Mineral acoustic lay-in tile in metal frame suspended ceilings are provided in the Chief's office and the Cab. The fire characteristics of these materials are unknown.

UTILITIES

HVAC

Air conditioning is provided for the Cab and the Chief's office

only. A combination unit providing both heat and cooling is provided for the office. The Cab unit is located on the roof and supplies conditioned air also to the 3rd floor since it is a common open area. The office unit is a wall type (Singer) taking fresh air through a permanent wall opening circulating directly into the office. There are no ducts used for circulation of conditioned air. Electric space heaters are provided on the other floor levels which have heating facilities only.

Electrical

Electrical power is purchased from the local public utility company. A utility owned transformer is located about 200 ft. west of the tower. 440 secondary voltage supplies the tower which uses 220 and 110 volts. The 220v is used for the air conditioning units and the remaining users are 110 volts. The tower radio equipment is DC, operating off an inverter located on the first floor equipment room with storage battery rack for use in an emergency case of power failure. Electrical power enters on the 1st floor to the main distribution panel and is transmitted to other floors through the plumbing chase in conduit. (See Vertical Shafts)

Fire Protection Water Supply

There is no in tower fire water system. Fire water protection is supplied by the city distribution system. Hydrants are located in the terminal area.

EXITING FACILITIES

There is only one normal egress means, the stairwell. (There is no elevator). In an emergency, there is also available an outside ladder with access from the Cab level only. The ladder goes from the Cab Floor level to within 8 feet of the ground. This system could be unusable in adverse weather conditions, for instance ice. The Cab has access to the stairwell through the 3rd floor Junction Room. There are no exit marking systems used. Battery powered emergency lighting units are provided in the stairwell.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire equipment only, consisting of 15 lb. CO₂ and 2-1/2 gallon soda-acid units. There are no Class A fire extinguishers provided for use in the Cab.

Detection and Alarm Systems

None. Public fire fighting facilities would be summoned by a telephone provided in the Cab.

Automatic Extinguishing Systems

None.

OCCUPANCY

The occupancies are typical of a small sized tower and consist of:

First Floor (165 sq.ft. net floor area - ground level): Consists of the equipment room containing the main electrical distribution panel, battery racks, inverter assembly and telephone equipment panel.

Second Floor (165 sq.ft. net floor area - floor elevation 10'): Chief's office and the elevator shaft used for stationery storage room.

Third Floor (165 sq.ft. net floor area - floor elevation 30'): Consists of the Junction Room, its radio equipment and recorder and a water closet. The elevator shaft area is used as a paper storage room.

Cab Level (110 sq.ft. net floor area - floor elevation 34'): This is a visual flight control cab with no radar capability. There is also a convenience unit provided for personnel with no cooking.

**Costs for Implementation
of Recommendations
(No. 6-H)**

1.	\$2500
2.	\$ 500
3.	\$1000
4.	<u>\$1500</u>
TOTAL	\$5500

**REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS**

REPORT NO: 7-H (Hunt)

LOCATION: WARWICK (PROVIDENCE), RHODE ISLAND - T.F. GREEN AIRPORT

SURVEY DATE: JULY 28, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. SKEFFINGTON - TOWER CHIEF

CONCLUSIONS

The tower has a partially open stairwell. Smoke tight shafts are not provided. An emergency escape hatch is provided at the cab level to an exterior ladder terminating 9 ft. above grade. This is considered to be of "last resort" value and not a recognized exit means. Early detection and notification of a smoke and fire condition is essential for safe internal egress system.

RECOMMENDATIONS

1. A complete products of combustion detection and alarm system should be installed throughout the tower. Alarms should automatically be sent to the fire department. Standby batteries should also be provided. An annunciator panel should be located in the cab.
2. The cable chase openings should be sealed with noncombustible materials on the first, sixth and seventh floors.
3. The first floor equipment room opening to the elevator shaft be covered and sealed in a fire resistive and smoke tight manner.
4. Enclose the cab staircase and its accessway to the tower stairwell. Provide a 1 hr. fire door for access to the cab accessway from the Junction Room.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. A cage should be provided around the exterior escape ladder, if retained.
- B. Class A type fire extinguishers (a 2-1/2 gal water type or equivalent) should be provided throughout the tower.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became operational in 1975 and handles approximately 270,000 operations a year. Radar facilities are located at another site. The tower is located away from the main terminal area, adjacent to a taxi runway and small plane parking area. The tower is not exposed by the main runways. No other structures are located in the immediate area. The area could be subject to high winds,

winter and summer storms.

Fire Fighting Services

The tower and airport facility are located adjacent to the City of Warrick, Rhode Island. The airport fire station is part of the city department. First alarm would bring 2 engine, 1 ladder, 1 rescue company with a total of 14 firemen. Ladders are of sufficient height to reach the cab level. The airport fire station is located approximately 3/4 miles away.

Hours of Operation and Personnel Loading

The tower is operational 24 hr. per day with a maximum number of seven controllers in the cab. Personnel on various floors are as follows: first - 0, second - chief, third - AFF chief, fourth - training room 3, fifth - maintenance room 3. Nights there are six in the tower. The cab at times can experience visitors, but visitation is kept to a minimum.

Self Inspection

Both the airport fire station and the city inspect the tower on a regular basis. Maintenance personnel inspect the tower's fire extinguishers on a monthly schedule. Due to the small size of the facility and limited personnel, a more elaborate procedure of self inspection is not required.

Emergency Procedures

Written procedures have been established for use in emergency situations including fire situations. The procedures are not posted.

Security

The tower is enclosed by woven wire fence with barbed wire at the top. Access to the tower and small parking lot is through a gate. The ground floor main entrance door is kept locked at all times. Proper intercom identification with cab personnel is required prior to being admitted to the tower.

CONSTRUCTION

General Description

The tower is of the Hunt design with seven stories and cab. The building is square with a hexagon shaped cab at the top. Each level has 400 sq.ft. gross area. Distance between levels is 10 ft.

The building is basically of noncombustible construction with fire retardant plywood used to cover the steel metal floor decking. The structural frame is unprotected steel with sheet metal insulated sandwich siding. Cab walls are 1 in. insulated glass. Partitions are sheet metal sandwich type. The ground floor is all concrete.

Vertical Shafts

Three basic shafts are provided: the stairway, elevator and cable chase or shaft. The stairway shaft is described in the exiting section. The elevator equipment for the elevator (first to sixth floors served) communicates with the elevator shaft on the first floor electrical room. The stairway enclosure is also non fire rated. The cable chase is open from the 1st to 7th floors.

Interior Finishes

Floors are not covered on the ground level and have vinyl tile or carpeting on the upper levels. Office areas have suspended ceilings. Most of the interior finish is open. Fire characteristics of these materials are unknown.

UTILITIES

HVAC

The cab has its own heating and cooling system. Individual rooms on the different levels have their own combination air conditioning and heating wall units. The stairway is heated by small electric heaters. The ground floor is also not air conditioned. Heating is by electricity.

Electrical

Electric power is purchased from the local power company. Incoming power is at 208v, 3 phase, 3 wire with buried cables. Main power is distributed through three panels on the ground floor. At the time of the inspection, a 125 KVA emergency diesel generator was located on a trailer near the tower. Installation was not completed. There is presently no electrical cross connection between the airport and the tower systems. All power lines are in conduit.

Fire Protection Water Supply

The nearest fire hydrant is located approximately 350 ft. away. Two other hydrants are available at greater distances. Water availability at the tower is 13,000 gpm. Water mains are mostly 12 in.

EXITING FACILITIES

The internal stairway is the primary means of egress from the tower cab. The core stairway is not separately enclosed and any fire could make the stairway untenable. A secondary means of egress is provided from the cab by a small substandard rigid ladder attached to the outer skin of the tower. The ladder ends approximately 9 ft. from the ground. The fire department has an aerial ladder that can reach to the level of the cab.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection consisting of 15. lb. carbon dioxide fire extinguishers. There are no Class A fire extinguishers in the tower.

Detection and Alarm Systems

None. A direct line to the airport fire station is located in the cab level. The fire department can also be summoned by the use of public phones in the tower.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies for the various levels are as follows:

1st Floor: Telephone room, electrical equipment

2nd Floor: Tower chief's office

3rd Floor: Maintenance chief's office

4th Floor: Training room

5th Floor: Maintenance room

6th Floor: Equipment room

7th Floor: Toilet, tape storage

Cab Level: Air Traffic Control

Costs for Implementation

of Recommendations

No. 7H

1.	\$4,400.
2.	\$ 300.
3.	\$ 700.
4.	<u>\$1,500.</u>
TOTAL	\$6,900.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 8-M (Mock)

LOCATION: BAKERSFIELD, CA - MEADOWS FIELD

SURVEY DATE: MAY 12, 1976

SURVEYING ENGINEER: WILLIAM E. BACKES, P.E.

FAA PERSONNEL CONTACTED: JACK C. MC MILLEN, TOWER CHIEF
FRED O. WYRICK, CHIEF, AIRWAYS FACILITIES
SECTION, FIELD OFFICE
JIM BENCH, EMPLOYEES' REPRESENTATIVE

CONCLUSIONS

The Bakersfield tower is a new, modern facility of non-combustible construction located so that it is without fire exposure from other buildings and has clear access from all sides. Its single interior stairway is open from the first to the fifth floor and thus is not a protected exit path from all stories. Moreover, smoke and heat from a fire in any story can intrude into other stories through the stairway opening. The gross area of every story in the building is 1024 sq.ft. and the maximum travel distance from the most remote point in any story to the stairway is 35 feet.

If the recommendations offered herein are implemented, reasonably safe means of egress will be provided within the intent of applicable codes and standards in the judgement of the Engineer. Early warning of incipient fire will be assured and quick evacuation facilities through a protected exit path will be provided.

RECOMMENDATIONS

1. Provide enclosure of the stairway and elevator shaft (in common) in all stories by construction of 1-hour slab-to-slab partitions and installation of Class C -3/4 hr. rated fire doors, frames and hardware as follows (many of these will replace existing doors):

1st Floor - Install partition separating elevator machinery room and install fire doors at mechanical equipment and storage rooms.

2nd Floor - Install partition and fire door between corridor and electronic equipment room.

3rd Floor - Install fire doors at doorways to teletype room, receptionist's office and toilet room.

4th Floor - Install fire door between corridor and future radar room.

5th Floor - Install fire doors at all doors in the corridor.

All doors designated above to be fire doors are to have automatic door closers without hold-open stops.

2. An automatic, fully supervised products-of-combustion detection and alarm system should be installed throughout the tower building. The system should include detectors in the supply air ducts and all air handlers should be automatically shut down upon system actuation. The system should actuate audible alarms throughout the building and should be connected to the airport fire station. Heat detectors should be installed in janitor closets and the future emergency generator room. A standby battery power supply should be provided.

3. All openings between the cable shaft and other rooms in the building, particularly at the top of the shaft, should be sealed so as to have an equivalent fire resistance of approximately 1-1/2 hours and should be smoke-tight. Openings at the perimeter of the cab floor to the 5th floor ceiling area below should be similarly sealed.

4. Additional emergency lighting units should be installed to illuminate the 5th floor exit corridor and stairway to cab.

5. Although continued use of the present emergency egress facilities from the cab, involving portable ladders to the cab roof and from the cab roof to the lower roof and the use of the "sky-geni", are not considered necessary if the above recommendations are implemented, if the continued availability of these facilities is elected the following measures are recommended:

- a. Provide a fixed "fold-down" ladder in the cab providing access to the cab roof.
- b. Provide a fixed ladder with handrails and cage leading from the cab roof to the lower roof, affording safe access to the "sky-geni" equipment.
- c. In place of continued reliance on the "sky-geni" equipment, install an exterior ladder with cage from the lower roof to ground level.

GENERAL ASPECTS

Site Features and Conditions

The Bakersfield tower is located on flat terrain on the north-east perimeter of Meadows Field with agricultural land extending to the north and east.

Exposures

The possibility of flooding appears to be nil and exposure to brush fires is minimal. There is no protection against exposure to winds. The tower structure stands alone and is separated from other buildings by several hundred feet of clear land.

Fire Fighting Services

The Kern County airport fire department maintains duty personnel 24 hours per day at an airport fire station approximately one mile from the tower with response in less than two minutes with two crash/rescue type vehicles. A conventional fire department pumper is stationed off the field about two miles from the tower with response in about 3 minutes. The nearest fire department ladder truck with capability to reach the tower cab outside balcony is located approximately 15 minutes away. Access for this unit is impeded only by a standard "Cyclone" type fence and is considered adequate. A hot line telephone to the field fire station and county dispatcher is available in the cab.

Hours of Operation

At the time of the field survey the tower was operating 24 hours per day. On May 20, 1976 operational hours were reduced to 18 per day.

Personnel Loading

During any 18-hour daily period of operation, personnel in the building average six; three controllers in the cab, two office staff and one maintenance staff. The office and maintenance personnel are present only during an 8-1/2 hour day shift. Minimum manning is one controller in the cab and at least one other person in the building. There can be as many as seven FAA personnel in the cab.

On infrequent occasions, visiting groups of schoolchildren, senior citizens and other civic organizations tour the tower, principally the cab, and there can be as many as twelve persons in the cab for short periods of time.

Self Inspection

There is no formal self inspection program whereby a complete inspection would be made at one time and a log or inspection form completed. Tower personnel are cognizant of fire hazards and are stated to participate successfully in an informal continuous inspection program.

Emergency Procedures

A clear set of general emergency procedures has been prepared and is posted at all levels of the building. All personnel have been briefed in these procedures and voluntary drills in emergency exiting have been conducted.

Security

The main entrance door is locked to entrance at all times with access controlled by pushbutton code station and releasing circuit operated in the cab after satisfactory identification via intercom facilities between the entranceway and cab. The main floor doors are unlocked to egress at all times.

CONSTRUCTION

General Description

The Bakersfield Tower is a five-story and cab structure with a plan area of 1024 sq.ft. (32 ft. x 32 ft.) in all stories except the cab, which has an overall area of approximately 375 sq.ft. and a clear floor area of approximately 150 sq.ft.

The building is of non-combustible construction but not fire-resistant. Structural frame is unprotected steel, floors are concrete on steel pan, roof is steel deck with conventional built-up roof covering, interior shaft walls are concrete masonry and partitions are mostly plaster on metal studs. Suspended ceilings (partial) are mineral lay-in tile on conventional metal frames.

Horizontal and Vertical Fire Separation

Mechanical equipment rooms are separated from adjacent areas by what appears to be at least one-hour masonry walls; however, doors in these walls are not labelled fire doors. Doors are heavy, solid core with metal cladding and frames are steel.

The single stairway is not separated from other areas of each story as is required by most building codes and standards. Thus, most areas in all stories are connected by this open stairway and a fire in a lower story could result in smoke and heat spread to upper stories. Such spread of smoke, heat and combustion gases would temporarily be prevented from entering the cab by a normally closed (with automatic closing device) non-fire-rated door in the short corridor leading to the cab stairway.

There appear to be no other unprotected floor penetrations except for the elevator doors (discussed below) and some apparent openings between the fifth floor above-ceiling area and areas behind consoles in the cab. These could not readily be seen and examined because of obstructions such as ducts, etc. but when looking upwards above the suspended ceiling in the fifth floor lounge, small amounts of daylight could be seen in the vicinity of the cab floor perimeter. This does not positively confirm but indicates the possibility of potential smoke spread between the fifth floor and the cab.

Vertical Shafts

The elevator shaft appears to be of one-or two-hour construction but elevator doors are not labelled and do not appear to present adequate resistance to the passage of smoke, thus providing a

path for some vertical spread of smoke and gaseous products of combustion. In the fifth story (the elevator terminates at the fourth story), a door opens into the shaft area above a "shaft ceiling" of wood construction.

A cable shaft adjacent the elevator shaft carries signal cables to the cab. Access doors to this shaft at each intermediate stairway are labelled fire doors in metal frames. Cable penetrations to the cab at the top of the shaft are not sealed, however, permitting smoke and gases from a cable fire in the shaft to enter the cab area.

Other small vertical pipe chases appear to be properly constructed and penetrations sealed.

Interior Finishes

No unacceptable interior finishes were seen in the tower. Carpeting in a few areas is understood to be of the low flame spread type.

UTILITIES

HVAC

The entire building is air conditioned with compressor and heat exchanging equipment located outside at grade. Air handlers are located in a mechanical equipment room on the fifth floor with a heavy, metal clad, but unlabelled, door in steel frame separating it from the corridor leading to the cab. This room is now utilized as an emergency exit path to the exterior balcony surrounding the cab (See EXITING FACILITIES). Filters are understood to be non-combustible but were not inspected.

Heat is derived from electric resistance coils in the air distribution ducts to all areas in the building. Air is ducted to and from all rooms in a common system; where there are suspended ceilings supply air is ducted to ceiling diffusers and return air is ducted from ceiling inlets through above-ceiling areas back to air ahndlers. Unless the air handling system is shut down at the time of a fire, it is capable of distributing smoke throughout most of the building.

Separate manually controlled ventilating systems are installed in and for the second floor electronic equipment room and the cab. In the equipment room, exhaust fans and filtered air intake louvers are both located in exterior walls of the room. For the cab, an exhaust fan discharges from the cab ceiling and air intake louvers are located at the base of the stairway from the fifth floor to the cab. Normally closed but non-labelled doors prevent the cab exhaust fan from pulling air from the fifth floor corridor and other rooms. However, smoke could be drawn into the cab through suspected openings between the cab floor and fifth floor lounge and verified openings between the cab and the cable shaft, unless these openings are sealed.

Electrical

Power is supplied by Pacific Gas & Electric Co. from two sources to a substation transformer about one mile from the tower; automatic transfer facilities are provided. A single underground supply cable carries power from the substation to an outside dry-type service transformer at the tower.

Since October of 1975, there has been one power outage, lasting 3-1/2 hours. The lengthy duration was the combined result of a failure of the automatic transfer device at the PG&E substation and a breakdown in reporting procedures, which are understood to have since been revised to preclude a recurrence.

All electrical power wiring is well-arranged and in conduit.

There is no emergency generator at the tower although space is provided and a unit is to be installed if and when radar equipment is added to the tower.

Water Supply

A 6-inch underground main supplies the tower at the end of a long dead end run. A single double-outlet hydrant with pumper connection is located adjacent the tower. A 2-1/2 inch connection supplies a wet standpipe with an electric motor driven automatic pump rated at 70 gpm at 30 feet net head installed on a by-pass. Static pressure from the underground was read to be 58 psi.

PROTECTION

Manual Fire Fighting Facilities

There is a wet standpipe supplying hose cabinets with 75 feet of 1-1/2 inch linen hose and straight stream nozzle in each story. At least one 15 lb. CO₂ and one all-purpose dry chemical extinguisher are mounted in each story.

Fire Protection and Alarm Systems

None. There is a "hot line" telephone in the cab directly connected to the County Fire Department airport station and the County dispatcher.

Under present conditions, it is possible for a fire to start and progress undetected until seen or otherwise detected by tower personnel. While the combustible loading is not high and there is little continuity of combustibles, there are materials present which can produce generous quantities of smoke. Delayed detection can permit the single stairway exit path to become untenable because of heavy combustion products concentration, thus forcing personnel above the fire to use less desirable emergency exit facilities. The provision of automatic products of combustion detection equipment would serve to quickly detect incipient fire and to warn personnel and the airport fire department that a fire had been detected and, in the case of the former, where it had been detected.

EXITING FACILITIES

Normal Exiting

Normal exiting facilities from the tower consist of an automatic elevator extending to the fourth floor only and a single stairway extending vertically direct to the fifth floor where a corridor and two doors must be traversed to pass between this main stairway and a stairway between the fifth floor and the cab. The stairways are unenclosed and therefore open to all corridors of all floors. As a consequence, smoke, heat and other products of combustion entering the corridor in any story can spread to adjacent stories unimpeded and in the process can render the stairway impassable. Elevators, of course, cannot be considered as acceptable fire exit facilities and, in this case, the elevator is located adjacent the open stairway and the shaft itself is not sealed against the entry of smoke.

Emergency Exiting

At present, the only alternate means of emergency exiting is by means of a Sky-Geni unit with which one person at a time can descend by harness and braking device attached to a cable. The unit is said to be "FAA Approved" and permits descent to grade from the roof area outside the Cab. Access to this roof area from the cab is by means of a portable aluminum ladder through a trap door in the cab roof, then down to the lower roof by means of a second aluminum ladder stowed on the cab roof; use of this ladder is considered to be extremely hazardous even in non-emergency practice, to say nothing of emergency conditions. The Sky-Geni on the lower roof can also be reached from the cab by descending the normal stairway to the 5th floor, entering a mechanical equipment room and ascending a vertical ladder through a trap door to the lower roof area; this route involves less hazard to personnel and is considered preferable to the cab roof route. In either case, use of the Sky-Geni apparently is considered objectional by some personnel and the wisdom of its use without proper training, which apparently cannot be enforced, is questionable.

OCCUPANCIES

Occupancies are typical of a smaller tower and are as follows:

1st Floor: Lobby, storage room, vacant room to be used for future emergency generator, elevator equipment room, and mechanical equipment room.

2nd Floor: Electronic equipment room housing usual complement of receivers, amplifiers, recorders, test equipment, etc. A second room is occupied as a combination shop and office.

3rd Floor: This floor houses three offices and a teletype equipment room.

4th Floor: Most of this floor is devoted to a large room, now vacant, to house future radar equipment. The only other room is an office/conference room.

5th Floor: Aside from mens' and womens' lavatories, there is a mechanical equipment room housing air handlers, and a Lounge/Training room with lounge furniture, refrigerator, vending machines, electronic oven,sink, etc. There are no cooking facilities.

Cab: Occupancy is typical of all cabs.

**Costs For Implementation
of Recommendations
(No. 8-M)**

1.	\$6500
2.	\$5500
3.	\$4000 - Due to the lack of construction drawings only a rough estimate can be made.
4.	\$1400
5.	<u>None</u> - Elective item
Total	\$17400

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO.: 9-M (Mock)

LOCATION: BOISE, IDAHO - BOISE AIR TERMINAL

SURVEY DATE: JUNE 24, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: CHARLES R. HALL - TOWER CHIEF
JACK HUTCHINSON - N.E. REGIONAL SAFETY
MANAGER

CONCLUSIONS

The tower has an adequate stairwell arrangement, except there would be exposure to smoke under fire conditions. With the proper sealing of some openings in shafts and doors and extension of the smoke detection and alarm system to all areas an effective egress would be provided. The tower has a rope/sling system for escape from the 6th floor roof only which is not considered of any except last resort value. Some supervision of floor lobby doors should be considered to maintain the integrity of the stairwell.

RECOMMENDATIONS

1. The cable shaft has unsealed wiring openings on the 5th and 6th floor. On the 2nd floor, a similar opening has been plugged with combustible materials. These openings should be sealed in a fire and smoke resistant manner.
2. One of the lobby entering doors on the 3rd floor was blocked open. This and similar open doors reduces the effectiveness of the stairwell shaft under fire and smoke conditions. Supervision for the doors or improved self monitoring procedures should be established.
3. A louvered ventilated door is provided for the hoist room on the first floor. This in effect makes an open elevator shaft at the ground floor level. In order to make the shaft as smoke secure as possible, this opening should be covered with noncombustible materials. It should be noted that closing of this opening may effect the air circulation system in the tower.
4. The cable shaft is being used for combustible storage in some areas, particularly the 6th floor. Combustible materials should not be stored in the cable shaft and should be kept in separate storage areas suitable for combustible materials.
5. All areas presently unprotected should be equipped with smoke detectors including equipping the AHU's with automatic shut-down.

The following items are desirable for improving fire/life safety

protection but is not considered essential to the emergency egress system.

A. A Class A type fire extinguisher (equivalent to a 2-1/2 gallon water unit) should be provided for the Cab.

B. The hose connection provided on the roof of the 6th floor is subject to freezing consequently this would not be available during the cold periods of the year. Emergency procedures should recognize this so there would be no attempt to use it in the cold months.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became operational on June 18, 1975 and is located on hilly terrain at a 2558' elevation, the highpoint in the general area. The tower is located adjacent to the terminal facility. The area is subject to climatic extremes from hot in the summer to quite cold in the winter.

Fire Fighting Services

The tower and airport facility are located inside the city limits of Boise and receive full public protection. There is a crash fire station located on the airport premises. The Air National Guard also has a rescue unit in the area.

Hours of Operation and Personnel Loading

The tower is operational on a 24-hour per day basis with at least two controllers on duty at all times. There is a total employment of about 23 plus Airway Facilities personnel who work the general area. The main activity is daytime when the normal load is 5 in the Cab and 2 in the Chief's office.

Self Inspection

The tower has a safety officer, one of the Airway Facilities personnel. Monthly inspections are made by both the airway facility and the city fire department. Fire extinguishers are given a complete inspection and serviced on an annual basis.

Security

The ground level main entrance door is kept locked at all times. The door to the Cab level from the 6th floor is also kept locked. Proper identification is required before being admitted to the tower. The tower is completely accessible to the general public from the terminal area. The City provides permanent police patrolling in the terminal area.

CONSTRUCTION

General Description

The tower is a Mock type with six stories plus Cab building with a square configuration except for the set-back pentagon shaped Cab.

The gross area per floor is 1090 sq.ft. with the exception of the Cab which is about 400 sq.ft.

The building is of protected noncombustible/limited-combustible construction (NFPA 220). The structural frame is protected steel, floors are poured concrete on protected steel pans and supports and the Cab is all steel construction with exception of the walls which are mostly tempered glass.

The exterior walls of the tower proper are steel panels with insulated sandwich construction. Interior partitions are of steel construction, ceilings are open in mechanical equipment areas with suspended ceilings for cab and office areas of the tower.

Horizontal and Vertical Separation

The stairwell is not fully cut off on any floor level. The stairwell landing and elevator lobby area on each floor has two or more access doors from other sections of the floor with the exception of the 3rd floor which only has one door. All doors are UL rated 1-1/2 hour fire resistance. The cab level and the 6th floor are connected by separate cut-off staircase with a fire rated door closure at the bottom only.

The elevator shaft and service is provided on all floors with the exception of the cab. The elevator shaft is not completely enclosed. The shaft is constructed of concrete block fitted with ordinary metal center divided sliding doors which would not be smoke tight. On the 1st floor the shaft is open to the elevator equipment room which in turn opens onto the remainder of the floor through a hollow metal door with open air circulating louvers. The stairwell is constructed of concrete and/or protected steel for load bearing supports. The stairwell has a concrete block wall on one side, the exterior tower wall (steel insulated sandwich construction) on 2 sides and open on the 4th side.

Vertical Shafts

(For stairwell and elevator discussion, see the preceding section). The tower has 3 shafts or chases. The cable shaft is constructed of concrete blocks on 3 sides with an exterior tower wall forming the 4th. The shaft has a common (party) concrete block wall with the elevator shaft and faces the stairwell on one side. There are 1-1/2 hr. fire rated access doors on all intermediate floor areas. The shaft is used primarily for signal wiring which is PVC insulated without conduit. Electrical power wiring in conduit is also apparently located in this shaft. The shaft is completely enclosed on all floor levels except apparently open into the Cab area. The second shaft is a utility or piping shaft consisting of an all steel enclosure apparently sealed at all floor levels. This shaft contains the piping for steam and cold water to the air handling units on the upper floors as well as the domestic water, drains, waste, etc. This shaft does not present any fire or smoke problems.

The third chase is a mechanical unit whose exact function could not be ascertained. It, however, does not appear to present any inter floor fire or smoke problems.

Interior Finishes

There are no unacceptable finishes. Only the floors have finishing materials. These consist of carpeting and vinyl tile depending on the area of usage. Some floor areas are not covered. Ceilings in some cases are suspended consisting of mineral acoustic lay-in tiles on metal frames. The fire characteristics of the covering materials are unknown.

UTILITIES

HVAC

Heating is provided by a 30 psi steam boiler UL listed utilizing natural gas fuel. Steam is piped to the upper floor levels through the piping chase. Cold water piping for air cooling is handled in the same manner from the central air conditioning unit located on the first floor. Cold water is piped to the air handling units on each of the floors. Air is distributed from the AHU's through ducts in the concealed space above the suspended ceiling areas to the various floor rooms. There is no interfloor ducting except 6th to Cab. Fire dampers are provided in the outlet ducting of the air handlers as well as smoke detectors with alarms only, i.e. no shutdown. The air handlers take fresh air through the outside tower wall of the mechanical rooms.

Electrical

Electrical power is purchased from the Idaho Power Company, a private utility. Incoming power goes through a utility owned transformer located outside of the tower. Here the voltage is reduced to 440V and goes to the main distribution panel on the first floor for use throughout the tower at 110/230 via the cable chase. Emergency power is provided by a 50 KW 120/208/240 diesel engine driven generator which supplies essential users only. Battery powered lighting units are installed in most areas.

Fire Protection Water Supply

There is an in tower fire water system for hose stream use only. A fire water riser is provided from the ground level through the sixth floor and on to the roof all located in the stairwell landing area. Hose cabinets are provided at all levels except the roof of the sixth. No provisions were noted for preventing of freezing of the outside 6th floor hose connection. Fire water protection is provided off the Boise distribution system with hydrants located in the terminal area.

EXITING FACILITIES

There are two normal exiting methods, the elevator or the stairwell. The Cab floor level is 74' thus making the elevator the preferred method from most levels. In an emergency, there is also available a rope and sling system with access from the roof of the 6th floor only. Two devices are provided. There is no outside ladder system. There would also be available under dire circumstances a fixed ladder system in the cable shaft, which is accessible from the roof and all

intermediate floor levels to the ground floor. There is no exit signing. Lighting is on the emergency electrical system.

PROTECTION

Manual Fire Fighting Facilities

The tower has a first aid fire protection only consisting of Class B, C extinguishers and a hose station on each floor. Extinguishers consist mainly of 15 lb. CO₂ units and the hose cabinets have 50' of 1-1/2" hose with a spray nozzle.

Detection and Alarm Systems

The tower has both detection and alarm systems. Ionization type products of combustion detectors are provided on all floor levels except the second. However, there is a possibility there is a detector in the 2nd floor Telco room which was locked and not available to the inspector. In general, detectors are placed in the ceilings of the equipment rooms, outlet of the air handling units, the stairwell and the top of the cable shaft. However, the latter location could not be verified. A four zone system is provided with annunciator panels on the 1st and 6th floors. There is also a manual fire alarm system consisting of pull boxes on each floor stair landing. The pull boxes and detectors are all on the same alarm circuitry. None of the detection and alarm devices have any automatic shutdown functions, for example, air handling units.

Automatic Extinguishing Systems

None.

OCCUPANCY

The occupancies are typical of a moderate sized tower and consist of:

First Floor (820 sq.ft. net floor area - ground level): Mechanical equipment room with the air conditioning unit and the steam boiler, emergency generator room including the main electrical distribution panel and a storage room.

Second Floor (820 sq.ft. net floor area - floor elevation 12'1"): Consists of a telephone equipment room, the AF shop and the AF chief's office.

Third Floor (820 sq.ft. net floor area - floor elevation 24'2"): Consists of office areas, break room and a small file storage room.

Fourth Floor (820 sq.ft. net floor area - floor elevation 36'3"): Half of the floor is conference room and remainder is a small mechanical equipment room.

Fifth Floor (820 sq.ft. net floor area - floor elevation 48'4"):
About half of the floor area is electronic equipment room and a separate smaller mechanical equipment room.

Sixth Floor (775 sq.ft. net floor area - floor elevation 60'5"):
The entire occupancy is made up of the ready/training area.

Cab Level: (350 sq.ft. net floor area - floor elevation 73'8"):
This is a tracab with approach control over a radius of 30 miles and 12,000 ft. elevation.

Costs for Implementation

of Recommendations

(No. 9-M)

- | | |
|--------------|---------------------------------|
| 1. | \$250. |
| 2. | None - improved procedures only |
| 3. | \$100. |
| 4. | None - improved procedures only |
| 5. | <u>\$3800.</u> |
| TOTAL | \$4150 |

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 10-M (Mock)

LOCATION: EVANSVILLE, INDIANA - DRESS REGIONAL AIRPORT

SURVEY DATE: AUGUST 6, 1976

SURVEY ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: BURTIS ENDSLEY, AIR TRAFFIC CHIEF

CONCLUSIONS

The tower has an adequate stairwell system except for probable exposure to smoke under fire conditions. Sealing existing draft penetrations and providing a smoke detection and alarm system would make for a reasonable emergency egress system.

RECOMMENDATIONS

1. Automatic product of combustion detectors should be installed in all spaces (including cable chases) not already so equipped. The alarm should be transferred automatically to the fire department.
2. All cable openings in the cable shaft, as well as the cab floor, should be sealed with noncombustible materials in a manner equivalent to a 1 hr. rating.
3. The ionization detectors in the air handling units should be rewired to shut down these units if activated.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. A Class A type fire extinguisher (equivalent to 2-1/2 gal. water unit) should be provided on each level.
- B. Remove all combustible storage from the storage room under the stairway on the first floor.
- C. The outside ladder should be enclosed with a standard cage, if retained.
- D. There is a heavy concentration of combustible storage throughout the tower, including the cable shaft, that should be removed.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This level II tower became operational in December of 1975. At the

time of the inspection, radar was being installed resulting in heavy combustible storage in some areas. The area is not subject to any unseasonal severe climatic conditions. The tower is not exposed by any building in the immediate area. The tower is located across from the terminal building on the opposite side of the runways. The area is open to the general public. Public roads must be used to get to the terminal building. The general grade surrounding the airport is flat.

Fire Fighting Services

The tower and airport facility are located within the limits of the City of Evansville, Indiana and receive full public protection. The airport fire station is located in the terminal area and fire equipment must use public roads to gain access to the tower area. The airport fire station has two airpacks of 1 hr. capacity each. Five men and a chief man the airport fire station.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hr. per day basis with at least one controller on duty at all times. There is a total occupant load of 33 mainly because the tower is also used for training of personnel not associated with the tower itself. Maximum number of personnel in the cab is 10 with a minimum of 1. Twenty-three employees may occupy the lower portion of the tower during various times of the day with these levels vacant at night. The cab at times can experience visitors, but visitation is kept to a minimum.

Self Inspection

Fire extinguishers are inspected monthly by tower personnel. The fire department also gives training to tower personnel on use of fire extinguishers.

Emergency Procedures

Procedures common to all towers are used covering most natural occurrences. Specific procedures for this particular tower were not available.

Security

City police make rounds of the tower area at various times during the day and night. The tower is open to the public with no fencing provided. The electric lock on the lobby door is activated from the cab level. A push button code panel and telephone are located at the lobby entrance door.

CONSTRUCTION

General Description

The tower is a Mock type with five stories plus cab and has a square configuration except for the cab. Each floor is approximately 1025 sq.ft. in area and the cab is about 500 sq.ft.

The steel stairway is located in one corner of the tower with the cable shaft, elevator shaft and hallway located adjacent to the stairway. The shafts and hallway are constructed of hollow concrete block.

The building is of noncombustible construction. (NFPA 220). The structural frame is unprotected steel. The floors have metal decking with lightweight concrete. The cab roof is built-up, metal decked with 1-1/2 in. rigid insulation. The cab walls are polished spandrel glass. Partitions in the office areas consist of wallboard on steel studs and end approximately 2 ft. from the ceiling. Exterior wall construction is insulated sandwich type metal panels on all sides.

Horizontal & Vertical Fire Separation.

Non-rated solid core doors in steel frames are used in all wallboard partitions. Individual rooms off the hallway have 1-1/2 hr. B labeled U.L. doors and frames with pneumatic closures. Basically both vertical and horizontal fire separation is lost where cables pierce shaft walls and floors. Curtain type fire dampers are installed in some ducts that pierce masonry walls.

Vertical Shafts

The tower has a cable shaft that runs from the ground floor to the cab. Access to the shaft is provided off the stairway landings by a 1-1/2 hr. B label metal fire door and frame. No closures are provided; however, the doors are normally locked.

A hydraulic elevator operates from the first floor to the fifth floor. Doors are non-rated. A small 1-1/2 hr. B rated door is provided at the top of the elevator shaft.

An enclosed pipe chase is provided from the 1st floor equipment room to the cab. Small metal doors in the equipment rooms provide access to the shaft.

Interior Finishes

There are no unacceptable interior finishes. Floors are carpeted or vinyl asbestos tiled in such areas such as equipment rooms. Fire characteristics of these materials are unknown. The cab has a suspended ceiling approximately 2 ft. from the roof. All ceiling tiles have a U.L. flamespread rating of under 50.

HVAC

Heating is provided by a listed combination gas and oil hot water boiler equipped for full automatic operation. A buried fuel oil tank supplies the boiler. Hot water is piped to other floors via the pipe chase. The air handling unit on the fifth floor only serves that floor and the cab above. The other AHU's on each floor serve that floor. Each air handling unit is equipped with an ionization duct detector that sounds an alarm only upon activation.

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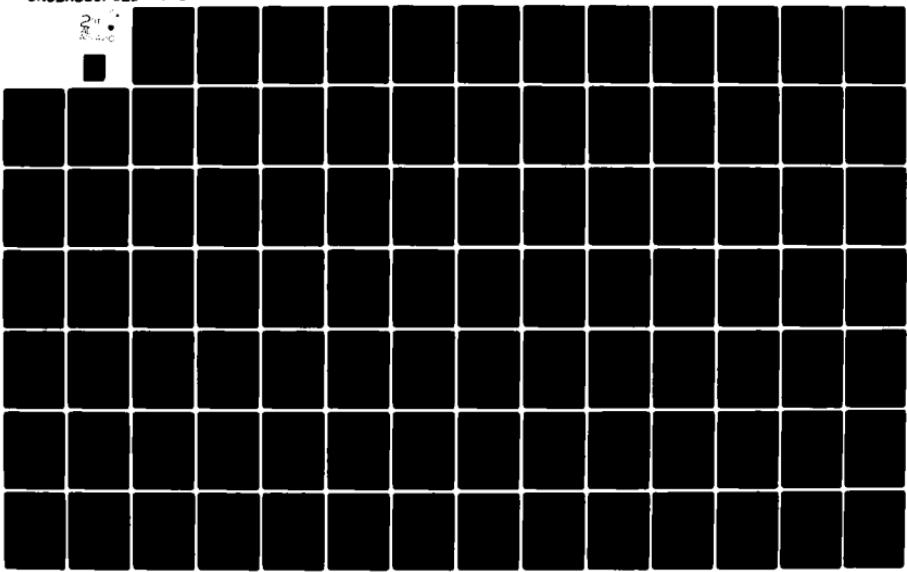
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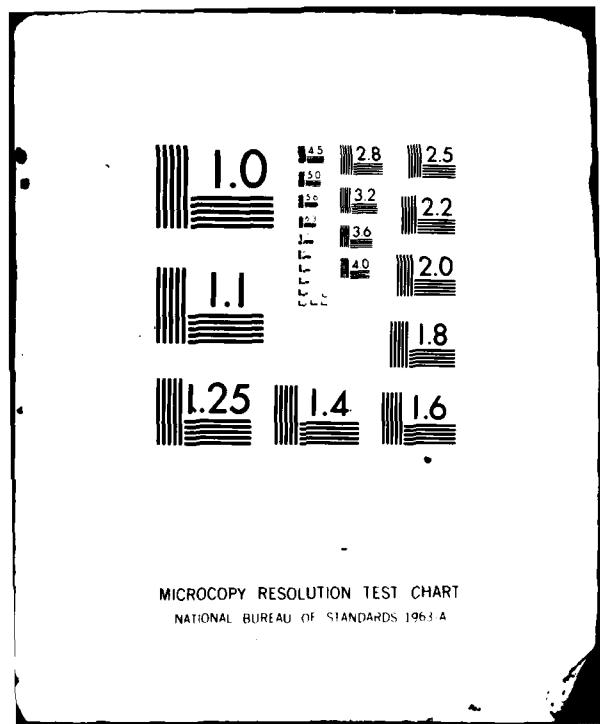
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Electrical

Electrical power is purchased from the Southern Indiana Power Company. Power is received at 2400 volts and reduced to 208/110 three phase, 4 wire by one 100 KVA oil filled transformer located approximately 10 ft. from the exterior wall. In tower distribution is from the main distribution panel on the first floor. All power lines are in rigid conduit. There is an automatic starting 62.5 KVA diesel engine driven emergency generator on the first floor that can supply the tower, load in case of power failure, through an automatic transfer switch. The emergency generator can supply the entire tower load except for the air conditioning systems and office lighting. An outside buried diesel fuel tank is provided. The telephone equipment room (Telco) is also located on the first floor. The equipment is all low voltage.

Fire Protection Water Supply

The airport fire water system is supplied from the City of Evansville water distribution system. Three hydrants are located approximately 100 ft. from the tower supplied by 6" to 8" mains with 100 psi static pressure. A 2 in. line feeds the domestic water to the tower.

EXITING FACILITIES

An internal stairway from the cab to the first floor is the primary means of egress from the tower. All openings to the stairway are protected by 1-1/2 hr. Class B fire doors. Partial secondary means of egress is provided. Personnel in the cab can climb onto the outside walkway, open an escape hatch located at the top of the cable chase, and climb down a fixed ladder to the fourth floor for access to the stairwell. An outside escape ladder, without a cage, is provided. Personnel in the cab also have access to the cab roof and hence by a short ladder to the outside walkway and ladder. Personnel on lower levels can use the interior stairway or elevator for means of egress.

Individual battery power emergency lighting units are located in the stairways and in important rooms. The majority of the lighting can be supplied by the emergency diesel generator.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection consisting only of 15 lb. carbon dioxide fire extinguishers. There is a deficiency of Class A fire extinguishers throughout the tower.

Detection and Alarm Systems

Ionization type smoke detectors are provided at selected locations throughout the tower and tied into a fire alarm system. Ionization type smoke detectors are also installed in all air handling units and sound an alarm upon activation. A fire alarm bell and pull station is located in the hallway on each level. All fire alarm

signals are for local alarm only. The control panel and annunciator are located in the mechanical equipment room on the fifth floor. The ionization detection circuits including the in-duct detectors, are separated into four zones.

The tower has a direct circuit to the central communication center of the Evansville Fire Department. The airport fire station can be called by telephone. The tower can also monitor the fire department radio frequency. The fire alarm system is also on the emergency generator circuit.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies for each floor are as follows:

All floors have 1025 sq.ft. except the cab.

1st Floor: Elevator machine room, storage room, emergency generator room, boiler room, telco room (ground level)

2nd Floor: Electrical equipment room (floor elevation 15')

3rd Floor: Mechanical room, electronic equipment room, janitors' room, toilet room (floor elevation 27')

4th Floor: Equipment room, 4 offices, toilet room (floor elevation 39')

5th Floor: Kitchen, equipment room, office (floor elevation 51')

Cab level: Air traffic control

Costs for Implementation

of Recommendations

No. 10M

1.	\$ 4,200.
2.	\$ 300.
3.	\$ <u>150.</u>
TOTAL	\$ 4,650.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 11-M (Mock)

LOCATION: FAYETTEVILLE, N.C. - GRANNIS FIELD

SURVEY DATE: JUNE 16, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: N. WAYNE CREEKMORE - SFO CHIEF

CONCLUSIONS

The tower lacks a fully reliable internal escape means. The stairwell lacks full fire segregation due to improper or lack of enclosures at each floor level. The escape facility to the roof of the fourth floor can only be considered a last resort egress means and fully dependent on outside help for removal. Providing and/or upgrading enclosures and access doors, closing ventilation openings in the cable shaft, and installing a products of combustion detection and alarm system would provide for an adequate emergency egress system.

RECOMMENDATIONS

1. Improvements should be made in the entire stariwell egress system so that it will be fully reliable under fire and smoke conditions. The following items need to be implemented to upgrade the egress system.
 - a. A one hr fire rated equivalent corridor should be provided on the fourth floor from the cab stairs to the tower stairwell landing. All corridor access doors should be 1 hr. minimum fire rating.
 - b. The aluminum louvered ventilator openings in the cable chase expose the stairwell escape route and should be blocked up with masonry units similar to the rest of the shaft. (Note: This could effect the tower ventilating system).
 - c. The fire doors at the entrance to the stairewll on floors 2, 3 and 4 have small wired glass metal frame windows which should be protected or covered to provide full 1-1/2 hr. resistance.
 - d. Procedures should be established for keeping doors to stairwells closed at all times. Presently many doors are latched open and would be ineffective in a fire emergency. (Note: it may be necessary to change the ventilating system on the third level so this could be accomplished).
 - e. A complete products of combustion detection/alarm system should be installed throughout.
 - f. The ventilation openings in the 4th floor air conditioning room door should be sealed in a manner equivalent to a 1 hr. fire rating.

2. The cable shaft should be completely sealed off in all areas so as to prevent smoke penetration into occupied areas. This applies particularly to the wiring and cable opening on the third floor. Also apparently, the cable shaft is not sealed near the top and smoke could permeate the Cab and possibly 4th floor areas.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

A. Class A type fire extinguishers (equivalent to a 2-1/2 gallon water unit) should be provided on all floors.

B. Combustibles are being stored in the equipment room of the third floor. Type type storage should be kept in segregated areas where it does not expose operating equipment.

C. Emergency Battery Powered Lighting Units should be provided in all areas below the 3rd floor which would be lighted only in the stairwells, in an emergency.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower is located on wooded rolling terrain within 200' of the terminal building all on the edge of the runway area. The area is in the east coast hurricane belt and would be subject to high velocity winds on occasions. The nearest structure is the Fire Station and the Emergency Generator Building, both about 100' distance.

Fire Fighting Services

The tower is located beyond the corporate limits of Fayetteville and located in Cumberland County. The land is owned by the municipality. Fire protection is provided by a combined county fire and police system. The airport crash station is located adjacent to the tower. The station has no equipment that can reach the cab level of the tower. The cab is equipped with a hot line telephone with direct connections to emergency departments.

Hours of Operation and Personnel Loading

The tower is operational on a 24-hour a day basis with at least 4 controllers on duty at all times. There is a total employment of about 20 both Air Traffic and Airway Facilities personnel. Airway Facilities people work a sixteen hour day and the administrative and office personnel are normally 8:00 AM to 5:00 PM weekdays.

The main activity is daytimes when the normal load is a total of

24, 10 of these are in the Cab and the remaining 14 uniformly distributed on the lower floors. The airport has 250-300,000 operations per year. Air carriers are under the approach control jurisdiction of the Washington, DC center and private aircraft are visual-radio controlled by the tower.

Self Inspection

There is no formal inspection program whereby a complete inspection would be made at one time and a log and inspection form completed. Fire extinguishers however are inspected on a monthly basis with recharging or servicing on an annual basis by others. The Chief makes a housekeeping inspection semi-annually. The tower is compact so that all areas are seen by someone daily.

Emergency Procedures

Emergency procedures have been established for use in all kinds of emergency situations, primarily for evacuation. These cover most natural occurrences in addition to fire related malfunctions. While procedures are not "posted" personnel reportedly are familiar with their duties in an emergency.

Security

The main floor entrance door is kept locked at all times. Proper identification is required before being admitted to the tower. The general tower area is open and generally available to the public as it is part of the overall terminal complex.

CONSTRUCTION

General Description

The tower is a Mock type with four stories plus Cab building, with a square configuration with the exception of the Cab which is pentagon shaped. The overall plan area is 1089 sq.ft. (33' by 33') and the Cab area is 384 sq.ft. The building is of prot. noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are poured concrete on steel pans and the Cab roof consists of steel deck. The exterior walls are steel panels apparently of an insulated sandwich construction. Interior partitions (nonbearing) are constructed of concrete block. Only the 4th floor and Cab have suspended ceilings.

Horizontal and Vertical Separation

The stairwell is enclosed on 3 sides only. Two sides are steel and the third is concrete block. The stairway is separated from other areas of the Floor on the 4th floor only. On the second and third floor, the landing area opens into two or three other rooms or areas and while not strictly according to code, should be effective assuming fire rated closures are provided and maintained closed. (Note, these two conditions are not being fully met). The stairway on the first level is fully open and is similarly arranged as the

second and third floors except, in addition, opens onto the stair landing entry door. The 4th floor has a separate and central staircase to the Cab level. This is completely open thus the 4th floor and Cab level would be a single fire area.

There is no standard cut-off of the stairwell from other areas. This is due to the use of non-fire rated doors on most entries off the stairwell landings. These doors have deficiencies, in otherwise satisfactory doors, such as open louvers, wired glass windows and use of unrated metal (fire) doors. The stairwell is of concrete block and steel construction with metal stairs on unprotected steel supports. The individual rooms on each floors mostly have ineffective fire separation due to the use of open louvers in the doors. Doors in some cases are kept latched open to provide for better air circulation.

Vertical Shafts

(For stairwell discussion, see the preceding section. There is no elevator). The tower has three shafts or chases. One is for electrical and signal wiring, cables, etc., the second is the open elevator shaft, and the pipe or utility chase. Details on the pipe shaft are lacking, however, apparently is open from the first to fourth levels and contains water piping and possibly the incoming power distribution in conduit. There were no observable openings in this shaft, and apparently presents no adverse fire hazard. It has 3 concrete block walls and the fourth is formed by the outside steel tower walls.

The cable shaft is constructed of concrete block on 3 sides and the fourth is steel formed by the outside tower wall. The shaft is open from the first to the fourth levels. This shaft also serves as the air intake for the ventilating system for the tower. This includes moveable louvers in the wall facing the stairwell. There are openings in this shaft consisting of aluminum ventilating louvers opening onto the stairwell, unsealed poke-throughs for wiring and apparently is open at the top into the Cab area, however this latter point could not be definitely ascertained. The cable shaft has 1-1/2 hour rated fire doors at the stair landings at all intermediate floor levels. The elevator shaft (all concrete block) has no elevator equipment and is used principally for hoisting heavy equipment to the upper levels.

Interior Finishes

There are no unacceptable interior finishes. Floors have vinyl tile, carpeting, or are not covered depending on the area of usage. Suspended ceilings are provided in some areas although the ceilings are mainly open. These consist of mineral lay-in tiles on steel frames. The fire characteristics of these materials are unknown.

UTILITIES

HVAC

Heating is provided by UL labelled electric heated hot water

heater (Boiler). Hot water is piped to other floors via the pipe shaft to supply the hot water coils in the various air handlers on the individual floors. The heater is located in the mechanical equipment room on the first floor.

Air conditioning units are provided on all floors and provide the cooling for the specified floor with the exception of the fourth which has a dual sized unit used for both the fourth floor and the Cab level. Other than this system, there is no interfloor distribution of cooling air thus there is no duct penetration of floor areas. Return air ducts are not provided and circulation is throughout the floor area, thus necessitating openings in doors which nullifies any fire segregation in most areas. There is no smoke travel impediment from the 4th floor to the cab level as well as between rooms on each floor. Fibreglass type filters are used in the air handling units.

Electrical

Electric power is furnished by the Public Works Commission of the City of Fayetteville who in turn buy power from Carolina Power and Light Company, i.e. Fayetteville does not generate any electricity. The supply is to an outside transformer owned by the city where the primary voltage of 4800 is reduced to 100/208 volt for use in the tower. The main distribution panel is located in the mechanical equipment room on the first floor of the tower. The distribution to the upper levels is apparently in conduit in the pipe shaft although it could not be definitely ascertained that this is not in the cable shaft. The telephone equipment room (TELCO) is located on the second floor. All equipment is low voltage and has battery-standby power.

Emergency power is provided by a 25 kva unit located in a separate and detached building. This was not inspected.

Fire Protection Water Supply

There is no in tower fire water system. Apparently fire water is supplied off the city of Fayetteville water distribution system. There are a couple of hydrants with pumper connections located within 250' of the tower.

EXITING FACILITIES

The tower has only one method of egress, the stairwell. This would be used in normal exiting as well as emergency exiting. The stairwell does not meet code requirements. Cab personnel have access to the tower stairwell only by means of 4th floor where it is necessary to pass through office occupancy to reach the tower stairwell proper. It is possible to reach the roof of the 4th floor via a ladder and hatch but this would be considered only as a last resort procedure. The emergency electrical generating system supplies all functions from the third floor to the Cab i.e. first and second floors do not have any emergency power. However battery operated lighting units are provided on the stairwells on all floor levels. There is no exit signing.

PROTECTION

Manual Fire Fighting Facilities

The tower has a first aid fire protection only consisting of 15 lb. CO₂ units on all floor levels. There are no Class A units provided for offices and similar occupancies.

Detection and Alarm Systems

NONE. Public fire fighting facilities would be called by a red phone hot line in the Cab with direct line to the fire station, and dial telephones would be used from other areas.

Automatic Extinguishing Systems

NONE

OCCUPANCY

Occupancies are typical of a small tower and consist of:

First Floor (840 sq.ft. net floor area - ground level): Mechanical Equipment Room which essentially consists of a hot water heater, electrical distribution panels, and air conditioning unit; SF0 Offices and a record storage room.

Second Floor (900 sq.ft. net floor area - floor elevation 12'1"): TELCO room; Future TELCO expansion area now storage; training and air conditioning equipment room; two water closets; janitorial room and a janitors equipment storage room.

Third Floor (880 sq.ft. net floor area - floor elevation 24' 2"): Two thirds of the floor area is occupied by the electronic equipment room housing primarily radio transmitter equipment. One-third the area is the air conditioning equipment and shop room, which is overcrowded and used for storage of combustibles.

Fourth Floor (1025 sq.ft. net floor area - floor elevation 36'3"): Has three main rooms consisting of the air conditioning room and miscellaneous storage. This room has an escape ladder through the roof to an outside area adjacent to the Cab, the Tower Chief's office and secretarial reception area and the ready room for Cab personnel.

Cab Level (380 sq.ft. net floor area - floor elevation 49'-6"): Radio and radar for flight approach control for about a 50 mile radius.

Costs for Implementation

of Recommendations

(No. 11-M)

1. a) \$1000
 - b) \$400.
 - c) \$150.
 - d) None - procedural only
 - e) \$5500.
 - f) \$100.
2. \$500.
- TOTAL \$7650**

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS

REPORT NO: 12-M (Mock)

LOCATION: GREENSBORO, NORTH CAROLINA - GREENSBORO/ HIGH POINT/
WINSTON-SALEM REGIONAL AIRPORT

SURVEY DATE: JUNE 18, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: CHARLES CARMICHAEL - TOWER CHIEF
HARRY GIBSON - UNIT CHIEF
GEORGE MC CONNELL - WASHINGTON, DC
KERMIT GRAYSON

CONCLUSIONS

The tower has an ineffective internal emergency egress system due to the lack of a complete cut off stairwell. With some remodeling and the installation of a products of combustion detection and alarm system an adequate means of egress would be provided. Provisions have been made for escape to the roof of the sixth floor which is considered a last resort procedure, only and not a recognized exit.

RECOMMENDATIONS

1. A products of combustion detection and alarm system should be installed throughout the tower including the air handling ducts. This should include automatic shut down of the air handlers.
2. All openings in the cable shaft facing on the stairwell should be completely blocked to match the existing block construction in that wall and forming a tightly closed opening.
3. Complete enclosures with an equivalent fire rating of one hour should be provided at the entrance to the staircase on floor 3, 5 and 6. In addition, on the third floor, it will be necessary to relocate the existing door in the mechanical equipment room so that it will be on the floor side of the recommended fire door. This is necessary to provide effective cut off of the stairwell and will allow the air recirculation to the equipment room.
4. The open piping chase holes (6" x 30") provided on each floor should be completely sealed to provide an effective fire and/or smoke cut off, equivalent to a 1 hr. fire rating.
5. The 16" x 16" access opening used for the elevator worm gear removal located between the elevator equipment room and the storage room should have an effective noncombustible secure smoke tight cover installed.
6. The louvered ventilators in the doors exposing the cab stairway accessway to the tower stairwell should be sealed or covered in a manner to give an equivalent 1 hr. fire rating and be smoke tight.

The following items are desirable for improving fire-life safety

protection but is not considered essential to the emergency egress system.

A. A Class A type fire extinguisher (equivalent to a 2-1/2 gallon water unit) should be provided on all floors except 4 which has electronic equipment only.

B. A self-inspection program should be established with monthly inspection guide from a check list.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became operational in 1967 and is located on hilly terrain with no extreme rises in the vicinity of the airport. The tower is located across the runway complex opposite the terminal facility in the general aviation area. The general aviation structures are over 200' from the tower proper. The area is subject to high wind conditions on occasions as the area can be influenced by the east coast hurricane belt.

Fire Fighting Services

The entire airport facility is located outside the city limits of Greensboro in Guilford County. Fire protection is provided by the county fire department. There is a crash station (foam and rescue) on the premises. This station also has the headquarter facilities for the county fire department. A second fire station is located about 1 mile from the airport. A direct line telephone system would be used to summon the fire department.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hour per day basis with at least two controllers (one in the Cab and one in the Tracon Room) at all times. There is a total of employment of about 64 including 10 Airways Facilities personnel. The main activity is daytime when the normal load is 5 in the Cab and 8 in the Tracon Room, 4 administrative and 6 in Airway Facilities.

Self Inspection

There apparently is no formal self inspection program of significance. The tower does have a safety committee. Fire extinguishers are weighed on a quarterly basis and recharged or serviced as required. There is no extinguisher inspection practice.

Emergency Procedures

Written procedures have been provided for use in emergency situations. These cover most natural occurrences in addition to fire related malfunctions.

Security

The ground level main entrance is kept locked at all times. Proper

identification is required before being admitted to the tower. The tower is completely accessible to the general public off local highways. A fencing system does separate and enclose the nearby general aviation facilities.

CONSTRUCTION

General Description

The tower is a Mock type with six stories plus Cab building with a square configuration except for the set back pentagon shaped Cab. The gross floor area is 1090 sq.ft. with exception of the Cab which is about 390 sq.ft.

The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are poured concrete on steel pans and the Cab is of all steel construction with the exception of the walls which are mostly tempered glass, the remainder is steel. The exterior walls of the tower proper are steel panels apparently of an insulated sandwich construction. Interior partitions are of concrete block construction. Ceilings are open in mechanical and equipment areas with suspended ceilings in the Cab and the office areas.

Horizontal and Vertical Fire Separation

The stairwell is not fully cut off on any floor level. It is completely open on the first floor. On the 3rd, 4th and 6th floors, the stairwell landing and elevator lobby areas have two access doors, which are not fire doors, from the other sections of the floor. The 2nd and 4th floors have a common stair-landing-elevator-lobby area which is effectively cut off from the remainder of the floor by a single fire door. The Cab level and sixth floor are a common fire area connected by a separate open staircase. The staircase shaft is mostly constructed of concrete block. It is open to the elevator lobby-stair landing area. One corner consists of two ordinary glass in metal frame windows. Each window segment is from floor to ceiling and 3' wide. No elevator service is provided above the 5th floor. The shaft is completely concrete block enclosed and equipped with metal doors, at all levels, which are loose fitting, i.e. non smoke tight. On the first level, elevator shaft is open to the elevator equipment room which in turn opens onto the remainder of the floor through a hollow metal door. There is also a small opening in the wall to the adjacent storage area hence to the emergency generator room through a hollow metal door. Thus a fire in the storage room or generator room could communicate smoke throughout the elevator shaft and hence to other floor areas.

Vertical Shafts

(For stairwell and elevator discussion, see the preceding section). The tower has 3 shafts or chases. The so-called cable shaft is a concrete block enclosure with 1-1/2 hour UL access fire doors at every intermediate floor level. In addition, the shaft has

adjustable ventilating louvers in the wall on the stairwell side. This could allow for fire and/or smoke exposure to the stair shaft. The cable shaft is used primarily for signal wiring which is PVC insulated without conduit. The second shaft is a utility or pipe shaft which has three sides of concrete block and the fourth formed by the metal wall panels of the tower. This pipe shaft has piping for sewerage, wastewater and domestic water. This shaft apparently has no unsealed openings to any floor however it does not present any fire or smoke problems. The third chase is entirely open from the first floor to the Cab level and consists of 6" x 30" openings in each floor through which the heating, air conditioning, hot and cold water piping and the electrical power conduit passes. These openings are not sealed and thus there is full communication from the first to top levels.

Interior Finishes

There are no unacceptable interior finishes. Only the floors have finishing materials. The ceilings in some areas have drop ceilings consisting of mineral acoustic lay-in tiles on metal frames. The floor coverings consist of carpeting and vinyl tile depending on the area of usage. Some areas such as the equipment rooms have no floor coverings. The fire characteristics of these materials are unknown.

UTILITIES

HVAC

Heating is provided by a 112.5 kw UL labeled electric heated hot water boiler. The hot water is pumped to the upper floor levels via an unenclosed piping chase through 6" x 30" holes in floor. The cold water piping for air cooling is handled in the same manner from the air conditioning unit on the first floor. Both the hot and cold water goes to the individual air handling units on each of the floors, except the Cab which is supplied from the 6th floor air handler. The total capacity of the air conditioning system is 60T. The air handling units present problems in effectively cutting off the vertical egress system on some floors. Air is distributed from the air handlers through ducts in the concealed space above the suspended ceilings to the various floor rooms. There is no inter-floor ducting. However, the return air is circulated through the rooms proper and hence through louvered doors and back to the air handling unit. The use of louvered doors nullifies the fire and smoke effectiveness of the shafts in some instances.

Electrical

Electrical power is purchased from the Duke Power Company, a private utility company. Incoming power goes through a Duke owned 14.4 KV transformer located outside of the tower. Here the voltage is reduced to 110/230 and goes to the main power distribution panel on the first floor for use throughout the tower. Power outages occur at fairly frequent intervals. However, emergency generator capacity is provided in case of supply difficulty. The generator is diesel engine driven and rated at 50 kw with an outside adjacent

buried diesel fuel tank. The emergency generating system supplies all facilities on floors 2, 4-6 and the Cab with the exception of the air handling units. The lighting in the stairwells on all floors is not on the emergency generating system. There is no emergency power supply to the first and third floors which includes the hot water boiler. Emergency lighting facilities (battery operated) are on order and to be installed throughout the stairwell. The telephone equipment room (TELCO) is located on the second floor and is equipped for standby battery power.

Fire Protection Water Supply

There is no in tower fire water system. Fire water is provided by a county system with the nearest hydrant about 300 feet.

EXITING FACILITIES

There are two normal egress methods, the stairwell or the elevator. The Cab floor level is 74' thus making the elevator the preferred method from most levels. There are no other egress methods available in an emergency. The instructions are not to use the elevator, thus the staircase is the primary emergency egress method. There is no elevator service above the fifth floor. Cab personnel must pass through exposed areas of the 6th floor to reach the tower stairwell. There is a ladder from the sixth floor through a roof hatch for access to the sixth floor roof. This might provide some refuge in an extreme emergency if the internal egress methods were unusable. Emergency generator supplied power is not provided to the first or third floors or any of the lighting in the stairwells. The tower has emergency battery operated lights on order for use in the stairwells, but at the present no emergency lighting is available. There is no exit signing.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of 15 lb. CO₂ units on each floor. There is a deficiency of Class A units for office type occupancies and the cab. The extinguishers are weighed quarterly and receive annual full maintenance checking and recharging if necessary.

Detection and Alarm Systems

None. The fire department would be summoned by telephone.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies are typical of a moderate sized tower and consist of:

First Floor (1,000 sq.ft. net floor area - ground level): Mechanical Equipment Room which has the air conditioning unit, boiler and small air compressor; Emergency Generator Room, Elevator Hoist Equipment Room, Two SFO offices and a small storage room.

Second Floor (900 sq.ft. net floor area - floor elevation 12'1"): The major area is the Telco with smaller areas consisting of SFO storage and air handling equipment room, separate storage room and 2 water closets, and a janitor's supply room.

Third Floor (900 sq.ft. net floor area - floor elevation 24'2"): Consists of about 5 equal areas, four of which are offices and the fifth is the air handling equipment room and AT storage.

Fourth Floor (900 sq.ft. net floor area - floor elevation 36'3"): Consists entirely of electronic equipment room utilizing solid state communication and navigational aids monitor and a multi-channel recorder for use with radio and radar approach control equipment.

Fifth Floor (945 sq.ft. net floor area - floor elevation 48'4"): Consists principally of the Tracon room with the radar tub units and seven operators. The remainder of the area is the combination air handling equipment room and office space.

Sixth Floor (945 sq.ft. net floor area - floor elevation 60'5"): There are about 3 equal areas or rooms consisting of the ready room, training room and the air handling equipment and storage room.

Cab Level (390 sq.ft. net floor area - floor elevation 73'8"): Radio flight approach control over approximately 50 x 100 mile area.

**Costs for Implementation
of Recommendations**

(No. 12-M)

1.	\$ 7000
2.	\$ 600
3.	\$ 2500
4.	\$ 600
5.	\$ 50
6.	\$ <u>500</u>
TOTAL	\$11,250

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 13-M (Mock)

LOCATION: LINCOLN, NEBRASKA - MUNICIPAL AIRPORT

SURVEY DATE: JUNE 22, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: FAY E. WEBB, TOWER CHIEF

CONCLUSIONS

The tower has a fire adequate stairwell arrangement that would be exposed to smoke under fire conditions. With the proper sealing of openings, an effective egress would be provided.

RECOMMENDATIONS

Detailed recommendations are not being made due to the loss of some field notes which included some specifics. The tower is very similar to the Boise tower (No. 9-M) and the recommendations would also be similar. The Boise tower deficiencies basically concerned unsealed shaft penetrations, ventilated doors exposing shafts and/or stairways, and a partial smoke detection and alarm system.

GENERAL ASPECTS

Site Features, Conditions, and Exposures

This Level 2 tower is about one to two years old and located on flat prairie land of southeastern Nebraska. The tower is located adjacent to the terminal complex. The area is subject to climatic extremes from very warm in the summer to quite cold in the winter. It would also be subject to extreme wind conditions with possible tornado exposure.

Fire Fighting Services

The tower and airport facility are located inside the city limits of Lincoln and receive full public protection.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hour per day basis with at least one controller on duty at all times. There is a total employment of about 21. The main activity is day time when the normal load is 5 in the Cab and 2 in the Chief's office.

Self Inspection

Monthly inspections are made primarily of the fire extinguishers with semi-annual complete tower inspection. Fire extinguishers are given complete inspection and serviced on an annual basis.

Emergency Procedures

The tower has written procedures for evacuation in any emergency. The only internal means of escape are the elevator or the stairway. It is possible to go to an outside ledge at the Cab level for rescue by outside resources.

Security

The ground level main entrance door is kept locked at all times. Proper identification is required before being admitted to the tower. The tower is completely accessible to the general public from the terminal area.

CONSTRUCTION

General Description

The tower is a Mock type with six stories plus the cab building with a square configuration except for the set-back Cab. The gross area per floor is 1090 sq.ft. with the exception of the Cab. The building is of a protected noncombustible/limited-combustible construction (NFPA 220). The structural frame is protected steel, floors are poured concrete on protected steel pans and supports. The Cab is all steel construction with exception of the walls which are mostly tempered glass. The exterior walls of the tower proper are steel panels with insulated sandwich construction. Interior partitions are steel construction, ceilings are open in the mechanical equipment areas with suspended ceilings for Cab and office areas of the tower.

Horizontal and Vertical Separation

The stairwell is not fully cut-off on any floor level. The stairwell landing and elevator lobby area on each floor has two or more access doors from other sections of the floor. All doors are UL rated for 1-1/2 hour fire resistance. The Cab level and the 6th floor are connected by a separate cut off staircase with a fire rated door closure at the bottom only. Elevator shaft and service is not provided beyond the 5th floor. The elevator shaft is constructed of concrete block and fitted with ordinary metal center divided sliding doors which would not be smoke tight. The stairwell is constructed of concrete and/or protected steel for the load bearing supports. The stairwell has a concrete block wall on one side, the exterior tower wall on the two sides and is open on the fourth side.

Vertical Shafts

(For stairwell and elevator discussion see the preceding section). The tower has two shafts or chases. The cable shaft is constructed of concrete blocks on 3 sides with an exterior tower wall forming

the fourth. Shaft has a common (party) concrete block wall with the elevator shaft and also faces the stairwell on the second side. There are 1-1/2 fire rated access doors on all intermediate floor levels. The shaft is used primarily for signal wiring which is PVC insulated without conduit. Electrical power wiring is also apparently located in this shaft. The second shaft is the utility or piping chase consisting of an all steel enclosure. This shaft contains the piping for the hot and cold water to the air handling units on the upper floors as well as domestic water, drains, waste, etc. This shaft does not present any fire or smoke problems.

Interior Finishes

There are no unacceptable finishes. Only the floors have finishing materials. These consist of carpeting and vinyl tile depending on the area of usage. Some floor areas are not covered. Some suspended ceilings consisting of mineral acoustic lay-in tiles on metal frame are provided. The fire characteristics of the covering materials are unknown.

UTILITIES

HVAC

Heating is provided by a hot water boiler located on the first floor. The hot water is piped to the upper floor levels through the piping chase. Cold water piping for air cooling is handled in the same manner from the central air conditioning unit located on the first floor. Cold water is piped to the air handling units on each of the floors. Air is distributed from the AHU's through ducts in concealed spaces above the suspended ceiling areas through the various floor rooms. There is no inter-floor ducting except to the Cab from the 6th. Fire dampers are provided on the outlet ducting of the air handlers as well as smoke detectors with alarms only, i.e. no shut down services. The air handlers take fresh air through the outside tower wall of the mechanical rooms.

Electrical

Electrical power is purchased from the local public utility company. The tower receives electrical power at 440 volts at the main distribution panel on the first floor for use and distribution throughout the tower at 110/230. Emergency power is provided by diesel engine driven generator located on the first floor.

Fire Protection Water Supply

There is an in tower water system for hose stream use only. A fire water riser is provided from the ground floor level through the sixth floor and on to the roof, all located in the stairwell landing area. Hose cabinets are provided at all levels except the roof. A shut-off valve is provided on the 6th level so the outside portion could be drained during cold weather periods.

EXITING FACILITIES

There are two normal exiting methods, the elevator or the stairwell. The Cab floor level is about 75 feet thus making the elevator the preferred method from most levels. There is no other means for exiting in an emergency. The tower does not have any rope and sling system, outside ladders although the fire department could probably remove personnel from the Cab level with their ladder equipment. The stairwell is not completely enclosed, but it adequately arranged considering advanced warning would be provided by the products of combustion detection and alarm system. There is no exit signing. Battery powered lighting units are provided in the stairwell.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of Class B and C extinguishers and a hose cabinet on each floor. The hose cabinets have 50 feet of 1-1/2 inch hose with a spray nozzle.

Detection and Alarm Systems

The tower has both detection and alarm systems. Ionization type products of combustion detectors are provided. In general, detectors are placed in ceilings of equipment rooms, outlets of the air handling units, stairwell and top of the cable shafts. However, the latter location could not be verified. A four zone system is provided with annunciator panels provided. There is also a manual fire alarm system consisting of pull boxes on each floor stair landing. The pull boxes and detectors are all on the same alarm circuitry. None of the detection and alarm systems have any automatic shut down functions, especially for the air handling units. The fire department would be called by telephone.

AUTOMATIC EXTINGUISHING SYSTEMS

None

OCCUPANCY

The occupancies are typical of a moderate sized tower and consist of:

First Floor (about 800 sq.ft. net floor area-ground level): Mechanical Equipment Room with the air conditioning unit, steam boiler, emergency generator room including the main electrical distribution panel and telephone equipment room. (Telco).

Second Floor (about 800 sq.ft. net floor area - floor elevation about 12 feet): This is the AF Administration area consisting of offices and storage.

Third Floor (about 800 sq.ft. net floor area - floor elevation about 24 feet): The electronic equipment room with radar, communications and recording equipment.

Fourth Floor (about 800 sq.ft. net floor area - floor elevation about 36 feet): This is the future Tracon room presently minor misc. storage.

Fifth Floor (about 800 sq.ft. net floor area - floor elevation estimated 48 feet): AT administration office facility, mechanical room with air conditioning equipment.

Sixth Floor (about 800 sq.ft. net floor area - floor elevation estimated about 60 feet): The entire occupancy is made up of the ready-training areas.

Cab Level (about 400 sq.ft. net floor area - floor elevation estimated about 75 feet): This is the tracab.

Costs for Implementation

of Recommendations

(No. 13-M)

Specific cost estimates cannot be made due to loss of some pertinent field data. However, the tower deficiencies are very similar to those at the Boise-Tower No. 9-M. The total cost to upgrade the tower should be similar also. A rough total estimate of \$4000 should be in order.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 14-M (Mock)

LOCATION: PORTLAND, MAINE - PORTLAND INTERNATIONAL JETPORT

SURVEY DATE: JULY 25, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: JOHN RYAN - TOWER CHIEF

CONCLUSIONS

The tower does not have an adequate means of egress because of a partial smoke detection system and penetrations of the cable shaft and the cab floor. Extending the detection system to all areas and sealing the penetrations will provide an acceptable emergency means of egress.

RECOMMENDATIONS

1. An automatic products of combustion detection system should be installed in all spaces (including cable chases) not already provided with such. The entire system should be supervised with a trouble alarm indication. The alarm should be sent to the fire department.
2. All cable openings from the cable shaft, as well as the cab floor, should be sealed with noncombustible materials with asbestos cement board covering the opening where needed.
3. The hollow concrete block ventilation shaft located in the second floor electrical equipment room should be extended to the underside of the floor above.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. A Class A type fire extinguisher (equivalent to 2-1/2 gal. water unit) should be provided on each level.
- B. Remove all combustible storage materials from the storage room under the stairway on the first floor.
- C. The 1-1/2 in. fire hose in the hose cabinets should be removed from the dry standpipe.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became operational in June 1976 and is located across the runways and opposite the new terminal facility. There are no radar facilities located within the tower. The area is not subject to any severe climatic conditions. The only other structure in the immediate area is the airport fire station some 250 ft. distance. Terrain in the vicinity of the tower is flat.

Fire Fighting Services

The tower and airport facility are located within the limits of Portland, Maine. The fire department is fully paid. The airport fire station does not have an aerial ladder capable of reaching the cab but one is available from other stations and would be available in approximately 5 to 6 minutes. Airport response would be 2 engines, 1 ladder and 1 rescue companies.

Hours of Operation and Personnel Loading

The tower is operational from 7:00 am to 11:00 pm, 7 days a week. The total number of operational people assigned to the control tower is 20. Maximum number of personnel in the cab is 6 with a minimum of 3. Two occupy the office area during the day. The cab at times can experience visitors but visitation is kept to a minimum.

Self Inspection

The fire department inspects the tower annually. Fire extinguishers are checked monthly by maintenance personnel with an outside contractor doing all hydrostatic testing. There is no formal self inspection program for fire prevention and none is needed for this facility.

Emergency Procedures

Procedures have been established for use in emergency situations for this particular tower. These cover emergency evacuation procedures, power failure, flood, storm damage and bomb threat.

Security

The ground floor main entrance door is kept locked at all times. The door and panels on each side are of glass. Proper intercom identification is required before being admitted to the tower. The tower is not fenced in and is open to the public. An electric strike on the entrance door is released from the cab after proper identification. The door from the fifth floor hallway to the cab also has an intercom system with electric lock.

CONSTRUCTION

General Description

The tower is a mock type building with five stories and a cab with a square configuration running up to the cab level. Each floor area has approximately 1025 sq.ft. area with the cab area about 500 sq.ft.

The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel with lightweight concrete on metal decked floors. The cab roof is metal with 1-1/2 in. rigid insulation and a built-up roof. The cab walls are polished sprandrel glass. Interior partitions in the office areas are steel studs with wallboard to approximately 2 ft. from the ceiling. Exterior walls are insulated sandwich type metal panels.

Horizontal and Vertical Fire Separation

Non-rated solid core doors in steel frames are used in all wall-board partitions. Individual rooms off the hallway have 1-1/2 hr. B labeled doors and frames with pneumatic closures. Basically both vertical and horizontal fire separation is lost where cables pierce shaft walls and floors. The ventilation shaft wall on the second floor presently ends at the suspended ceiling. Curtain type fire dampers are installed in all ducts that pierce a masonry wall. Vertical separation is provided by the concrete floors and the enclosed stairway.

Vertical Shafts

The steel stairway is located in one corner of the tower with the cable shaft, elevator shaft and hallway located adjacent to the stairway. The shafts and hallway are constructed of hollow concrete block. The cable shaft runs from the ground floor to the cab. Access to the shaft is provided off the stairway landing by a 1-1/2 hr. B label metal fire door and frame. No closures are provided, however, the doors are normally locked. A hydraulic elevator operates from the first floor to the fifth floor and opens onto the stairway hallway. Doors are non-rated.

An enclosed pipe chase off the equipment room on the exterior wall also runs up the tower. Small metal doors in the equipment room provides access to the shaft.

Interior Finishes

There are no unacceptable interior finishes. Floors have carpeting in office areas and vinyl asbestos tile in other areas such as equipment rooms. Fire characteristics of these materials are unknown. The suspended ceiling tile has a UL flamespread rating of under 50.

UTILITIES

HVAC

Heating is provided by an approved combination gas and oil hot water boiler equipped for full automatic operation. Both low temperature and high water alarms are registered at the cab level. The cab level also receives low temperature alarms from each HVAC unit. An emergency cut-off switch for the boiler is located in the first floor lobby. The unit on the fifth floor only serves that floor and the cab above. Individual units on each floor serve portions on that floor. Each air handling unit is equipped with an ionization duct detector that sounds an alarm and shuts the unit down upon activation.

Electrical

Electrical power is purchased from the Central Maine Power Company. Power is received at 4160 volts and reduced to 208/110 three phase, 4 wire by two 75.KVA oil filled transformers located approximately 15 ft. from the exterior wall. Distribution is from the main distribution panel on the first floor. All power lines are in rigid conduit. There is an automatic starting 62.5 KVA diesel engine driven emergency generator that supplies the load of the tower through an automatic transfer switch should purchased power fail. The diesel fuel tank is buried outside. The telephone room (Telco) is also located on the first floor. The equipment is all low voltage.

Fire Protection Water Supply

Airport fire water is supplied off the City of Portland distribution system. A hydrant is located approximately 200 ft. from the tower on a 12 in. main with 100 psi static pressure. A 2 in. line feeds the domestic water to the tower. The standpipe system in the tower would be pressured by the fire department pumbers.

EXITING FACILITIES

An internal stairway from the cab to the first floor is the primary means of egress from the tower. All openings to the stairway are protected by 1-1/2 hr. Class B fire doors. Secondary means of egress is provided. Personnel in the cab must break a window, climb out onto the outside walkway, open an escape hatch located at the top of the cable chase, and climb down the chase ladder to the fourth floor. They must then open the fire door from the chase to the stairway. An escape ladder, without a cage, is reported to be installed. Personnel on lower levels use the interior stairway or elevator. The ladder system is of "last resort" value only.

Individual battery power emergency lighting units are located in the stairways and in important rooms. The entire lighting system is supplied by the emergency diesel generator. Exit signs are provided where needed.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection consisting only of 15 lb. carbon dioxide fire extinguishers. 1-1/2 in. hose station with 75 feet of rubber lined hose and combination nozzle are provided on a dry standpipe system. There is a deficiency of Class A fire extinguishers throughout the tower.

Detection and Alarm Systems

Ionization detectors are placed at selected locations throughout the tower and tied into a fire alarm system. Ionization duct detectors are also installed in all air handling units with automatic unit shut-down. A fire alarm bell and pull station are located in the hallway on each level. Announcer zone panels are located in the cab as well as the lobby on the first floor. The airport fire station is directly connected to a red phone in the cab. The fire alarm system is also on the emergency diesel generator. There is also central station supervision.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies for each floor are as follows: (all floors have 1025 sq.ft. except the cab)

- 1st Floor: Elevator machine room, storage room, emergency generator room, boiler room, telco room (ground level)
- 2nd Floor: Electrical equipment room (floor elevation 15')
- 3rd Floor: Mechanical room, electronic equipment room, janitor's room, toilet room (floor elevation 27')
- 4th Floor: Equipment room, 4 offices, toilet room (floor elevation 39')
- 5th Floor: Kitchen, equipment room, office (floor elevation 51')
- Cab Level: Air traffic Control

Costs for Implementation

of Recommendations

No. 14-M

1. \$ 4,200.

2. \$ 300.

3. \$ 400.

TOTAL \$ 4,900.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
FOR AIR TRAFFIC CONTROL TOWERS

REPORT NO: 15-NF (Non-FAA)

LOCATION: BALTIMORE, MARYLAND - BALTIMORE-WASHINGTON
INTERNATIONAL AIRPORT

SURVEY DATE: JULY 30, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. ART HARRISON - ASSISTANT TOWER
CHIEF

CONCLUSIONS

The tower lacks any adequate means of egress. The installation of a complete smoke detection and alarm system in all portions of the tower and terminal building should make for a reasonable egress system. Extensive construction and installation of automatic sprinkler system would also be required to provide a fully effective means of egress.

RECOMMENDATIONS

Recommendations No. 1 and 2 apply only if it is felt necessary to provide a means of egress meeting "code" requirements.

1. A noncombustible enclosed means of egress should be built on the third floor roof area, from the third floor tower stairway and terminating on the ground floor via a new stairwell. A new door opening at the bottom of the existing stairway will be necessary. This new exit facility will also provide a secondary means of egress for people on the third floor and eliminate the existing long dead-end corridor.
2. Automatic sprinkler protection should be provided throughout the second floor (non FAA occupied space) and third floor (a small portion occupied by the U.S. Weather Bureau). A supervised flow alarm should be included.
3. An automatic products of combustion detection alarm system should be installed in all areas of the tower and terminal building. Detectors should also be installed in the air handling units discharge ducts with automatic shut-down of the air handlers upon activation.
4. The cable openings in the ceiling of the electric room on the seventh floor should be sealed with noncombustible material.
5. All the wood doors in the electrical chase should be replaced with 1-1/2 hr. rated assemblies including frames.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. Additional water type fire extinguishers should be provided throughout the tower and office areas.
- B. The wood stairway doors should be replaced with 1-1/2 hr. B rated solid core metal doors and closers.
- C. All pressed wood fiber ceiling tile should be removed from the tower and office areas.
- D. Directional exit signs should be provided on the third floor office section where the way to an exit is not obvious.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The airport terminal building and tower were constructed in 1949. Additional construction was in process on the terminal at the time of the inspection. FAA occupies all of tower floors four to seven and the majority of the third floor. In the terminal building the second floor (open to the public) is occupied by various terminal tenants. The first floor is the carrier flight facility. The runway complex is adjacent. The area could be subject to severe climatic conditions such as high winds and summer storms. The tower is a part of the terminal building.

Fire Fighting Services

The entire airport facility is owned by the Department of Transportation of the State of Maryland. A fire station is located approximately 800 ft. away in a separate building. Equipment responding on the first alarm includes engine, rescue and tanker companies. Second alarm response includes three engines and one ladder (100') company. The fire station is manned 24 hrs. a day.

Hours of Operation and Personnel Loading

The tower is occupied 24 hrs. a day, 7 days a week. Maximum number of personnel in the cab is 6. Approximately 7-10 persons are in the equipment rooms, 3 personnel are in the material room and various people in offices. Total FAA personnel on the third floor during the daytime is around 25. This does not include the U.S. Weather Service complement.

Self Inspection

There is no formal self inspection program of significance. The fire department inspects the tower quarterly and the fire extinguishers are checked monthly by tower maintenance personnel.

Emergency Procedures

Written procedures have been established for use in emergency situations. Procedures are not posted.

Security

Main entrance into the third floor is by a locked enclosed stairway on the second floor or by the passenger elevator from the ground floor which terminates on the third floor. Occupants (non FAA) on the second floor also have access to this restricted elevator and it is possible for them to gain admittance to the third floor. Coded cards (3 classes) are required to operate the elevator.

CONSTRUCTION

General Description

The tower is a non-FAA, level IV activity and is located on top of the airport terminal building. The tower and office section (3rd floor) are constructed of reinforced concrete with brick and cinder block faced walls, and block and plaster partitions. Floors consist of reinforced concrete on a protected steel supports. The floors are not tight fitted to the outside window-wall areas thus allowing for possible interfloor fire and/or smoke communication.

Horizontal and Vertical Fire Separation

The tower section is a single fire area due to the exterior window arrangement. (See General Description.) The main stairway from the third to the seventh floor communicates with the elevator lobby through a solid core wood door with a 10 x 10 in. ordinary glass opening. The elevator services the third to seventh floors. An enclosed elevator lobby is provided on each floor. Stairwells are concrete with concrete stairs. None of the doors in the tower were fire rated with the majority of them varnished wood, many with large glass opening and/or louvers. Individual rooms are separated by noncombustible partitions.

Vertical Shafts

An electrical shaft runs throughout the tower and has concrete and block walls with wood access doors. Upper levels have concrete floors with the conduit sealed at each level. All enclosed ventilation shaft supplies air for all tower levels except the cab.

(For stairway discussion, see preceding section.)

Interior Finishes

Floor coverings consist of painted concrete, vinyl asbestos or carpeting. Majority of the walls are painted plaster. Pressed wood fiber ceiling tiles are glued on the ceilings of many rooms. Fire characteristics of the other materials are unknown although the wood tiles have been known to spread fire and give off large volumes of smoke and toxic gases.

UTILITIES

HVAC

Heating is supplied by hot water noiler located in a separate building. A small air handling unit is located in the mechanical space under the cab and serves the cab only. Two other air conditioning units are provided. Small individual unit heaters and radiators are provided for the stairway. Two condensing units are on the third floor roof, one 15 ton unit feeds the computer room and one 9 ton unit feeds the scope room. The air handling unit on the third floor supplies air for the other areas between three and seventh floors. There is a residential type smoke detector in the mechanical room under the cab.

Electrical

Electrical power is purchased from the local power company and supplies the airport from two directions from two separate generating stations. The 3rd floor air conditioning unit and elevator use 400 volts with the remainder of the tower on 208V, 3 phase, 4 wire or 110 volts.

A 125 KVA emergency diesel generator is provided. Lighting is supplied by this generator.

All wiring is in conduit in the electrical shaft.

Fire Protection Water Supply

City water pressure is about 55 psi. The mains in the area of the terminal are 12 or 8 in. Several hydrants are provided in the immediate vicinity of the terminal complex.

EXITING FACILITIES

The tower and office complex does not have an approved means of egress. Exiting from the cab level is provided by an enclosed stairwell, although it is not fire resistant due to the use of continuous ordinary glass windows along the outside wall. Stairway doors are also non-rated. The stairway terminates on the third floor. It is approximately 55 to 60 ft. to the stairway at the other end of the corridor. The corridor has numerous ventilation penetrations and door openings. The second stairway from third floor discharges into the center lobby of the second floor. The lobby area has glass walled office occupancies. An open stairway is provided to the middle of the airport terminal building. Battery powered light units are provided for the tower stairway. There are no exit lights.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection consisting of 15 lb. carbon dioxide and 2-1/2 gal. water fire extinguishers. There is a

combination fire extinguisher and hose station (1-1/2 in. hose and straight stream nozzle) on the third floor by the stairway running from 3 to 2. There is a deficiency of Class A units in the office area (3rd floor).

Detection and Alarm Systems

None. The airport fire department is summoned by a direct line from the cab. Ordinary phones may also be used by dialing a special three digit number.

OCCUPANCY

Occupancies for the different levels are as follows:

Cab Level: Air Traffic Control

7th Floor: Electrical shaft, electric room, toilet room, lobby; janitor's closet, elevator, ventilation shaft & pipe chase

6th Floor: Electric shaft, lobby, equipment room, ventilation shaft & pipe chase, elevator

5th Floor: Lobby, electrical shaft, elevator, ventilation & pipe shaft

4th Floor: Elevator, lobby, electrical shaft, data process room, mechanical room

3rd Floor: Electrical closet, material room, storage room, offices, scope room, equipment room, operations office.

Costs for Implementation
of Recommendations

No. 15-NF

1.	\$15,000
2.	\$20,000
3.	\$ 9,000
4.	\$ 500
5.	\$ <u>2,000</u>
TOTAL	\$46,500

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTR. TOWERS

REPORT NUMBER: 16-NF (Non-FAA)

LOCATION: EAST BOSTON, MASS. - LOGAN INTERNATIONAL AIRPORT

SURVEY DATE: JULY 27, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: WILLIAM KEPERS - TOWER CHIEF

CONCLUSIONS

Egress from the tower is provided by two fully enclosed separate stairways terminating on the ground floor. Shaft openings are properly protected except some cable penetrations. With an extended smoke detection system the means of egress should be satisfactory.

RECOMMENDATIONS

1. Cable openings on the 21st floor in the telco room should be sealed with noncombustible material and the openings covered with asbestos cement board.
2. Carpeting should be removed from the ceiling and walls of the stairway in the cab section if this material is not fire retardant.
3. Smoke detectors should be installed in the intermediate level directly under the cab and tied into the present system.
4. The pipe openings at the ceiling in the mechanical room on the 19th floor should be sealed with noncombustible material.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. The non FAA emergency generator should be checked to see if it can pick up the emergency lighting in under 10 seconds upon power failure.
- B. Specific fire emergency procedures should be written and supplied to all employees.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This new tower is set in between the south terminal and the north terminal with the runways in front of it. FAA occupied floors consist of the 17th floor to the cab. The floors end at 16 and resume again at 6. Parking occupies the space from 6 and down to 1. The area could be subject to severe climatic conditions, such as high winds, winter and summer storms.

Fire Fighting Services

The tower and airport facility are located within the limits of East Boston and receive full public protection. Neither the airport or the City has any equipment that can reach the cab level. Elevators would be used extensively for fire fighting if a fire occurs on the upper levels. The airport fire station is located approximately 1/3 mile away.

Self Inspection

There is no formal self inspection program of significance. Fire extinguishers are checked by tower maintenance personnel monthly with an outside contractor doing the hydrostatic testing.

Emergency Procedures

Standard written procedures have been established for emergency situations. These cover most of the natural occurrences. Procedures are not posted. Specific procedures for this particular tower were not available.

Security

The elevators stop at the 19th floor which is the office section of the control tower. A coded push button panel released the locking mechanism on the entrance door. Personnel going to the cab must pass through this door.

CONSTRUCTION

General Description

This tower is a non-FAA type and has a height of 309 ft. The entire building is basically reinforced concrete. The first floor is open with the second through sixth floors taken up by a large reinforced concrete parking garage. The twin towers are open from the sixth floor to the 16th floor. Most of the interior partitions are hollow concrete block or wallboard on steel studs. Office sections have suspended ceilings and short pile carpeting on the floor.

The building is classified as fire resistive (NFPA 220) with steel framework and reinforced concrete construction.

Horizontal and Vertical Fire Separation

The upper mechanical and equipment rooms are separated by hollow concrete block walls with openings protected by 1-1/2 hr. Class B rated fire doors. Floors are reinforced concrete. Stairway doors are 1-1/2 Class B rated fire doors.

Vertical Shafts

Both the stairway and the elevator shaft are constructed of hollow concrete blocks. Stairway openings are protected by 1-1/2 hr. Class B rated fire doors. The main ventilation shaft is an enclosed hollow concrete block shaft with fire dampers provided where the ducts pierce the walls of the shaft. The elevator has a non-rated metal door.

Interior Finish

There are no unacceptable interior finishes except for the excessive amount of carpeting in the cab area which may not be fire retardant. Floors have carpeting and vinyl tile in non-mechanical-utility areas (i.e. offices, training rooms, etc.). Fire characteristics of these materials are unknown. Suspended ceilings are provided in office areas.

UTILITIES

HVAC

Heating and ventilation is provided from the mechanical room on the 20th floor. Hot water is provided from the airport system by a boiler located in a separate building. The arrangement of the ventilation system could not be determined at the time of the inspection.

Electrical

Electric power is purchased from the local utility company. The main switchgear room for the tower is located approximately 80 ft. away in a separate building. All electrical wiring is in conduit.

Fire Protection Water Supply

Fire water is provided off the City water system at 90 psi. Water mains feeding the tower area are 6 in. A 6 in. standpipe is provided in the stairway. At the top of the standpipe there are two 2-1/2 in. hose connections. A 1-1/2 in. hose station with 50 ft. of hose is also provided on each level. A Peerless 500 gpm @ 215 ft. booster pump supplies the standpipe.

EXIT FACILITIES

Exiting from any story can be by either of the two stairways. However, cab personnel have direct access to one stairwell but must use the open roof area to reach the second stairway. Doors open only in the direction of egress (locked). All the lighting is on the emergency generator supplied circuit. Exit signs are provided where needed.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection consisting of 15 lb. carbon dioxide and 2-1/2 gal. water type fire extinguishers besides the 1-1/2 in. hose stations on the stairway landings. Extinguishers are uniformly distributed throughout.

Detection and Alarm System

A fire alarm pull box and local bell are located on each floor level of each stairway. The cab, as well as the telco room, mechanical room and equipment room, have ionization type smoke detectors. Alarms from the pull box, as well as the ionization detectors, are supervised by the Massport Authority Communication Center located in the airport. There is a direct line to the East Boston fire department via a red phone which is located in the cab. Heat detectors are provided in the non FAA occupied spaces. The alarm system has a separate circuit.

OCCUPANCY

Occupancies for the various levels are as follows:

Cab: Air Traffic Control

21st level: Instrument room, telco room equipment room ventilation shaft.

20th level: Mechanical room

19th level: All office area

18th level: Non FAA (State Police)

17th level: Non FAA (lounge)

16th level: Observation

15th - 7th: Open

6th floor: Access to old tower

5th-3rd: Parking garage

2nd floor: Parking, medical, restaurant

1st floor: Exits.

**Costs for Implementation
of Recommendations**

No. 16NF

1. \$ 300.
 2. \$ Labor only
 3. \$ 1500.
 4. \$ 100.
- TOTAL \$1,900.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 17-NF (Non-FAA)

LOCATION: CHANTILLY, VA - DULLES INTERNATIONAL AIRPORT

SURVEY DATE: AUGUST 2, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. REILEY - ASSISTANT TOWER CHIEF

CONCLUSIONS

The tower has one major means of egress from the cab level - the central stairway down to the ground floor. There is no secondary means of egress from the facility. The cab is at such an elevation that fire department ladder apparatus cannot reach it. Provision for a fire resistive passageway from the bottom of the stairway to the ground floor outside wall will provide a reasonable means of egress from the tower.

RECOMMENDATIONS

1. A 1 hr. rated passageway should be provided from the stairway on the ground floor to an exterior wall. Openings should be protected by rated fire doors and closers with panic hardware.
2. Cable penetrations in the cab floor should be sealed with non-combustible materials and the opening covered with asbestos cement board.
3. Additional smoke detectors should be installed so that all areas of the tower are protected. Detectors should be tied into the existing system.
4. Smoke detectors should be installed in the discharge of the air handling units for shut down of the units when smoke is present.

The following items are desirable for a fire-safety protection but are not considered essential to the overall emergency egress program.

- A. An additional exit sign is needed on the inside stairway at the ground level.
- B. Class A type fire extinguishers (equivalent to a 2-1/2 gal. water unit) should be provided throughout the tower.
- C. All fire extinguishers should be inspected on a regular basis and a record kept of the inspection date.

- D. The carbon dioxide fire extinguisher on the cab floor should be properly mounted.
- E. Tower personnel should be trained in the use of self-contained breathing units.
- F. The exit sign should be removed from the inside of the stairway - basement level so that the ground floor means of egress will be used.
- G. There is a need for an improved self-inspection program including providing a check list sheet to be used during the monthly inspection.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This level III activity tower was built in 1962 and is 186 ft. from the ground to the cab floor. The lower levels of the tower are also part of the terminal complex. The FAA owns the entire complex. The runway complex is directly in front of the tower. The roof of the terminal building exposes the upper portions of the tower. The area could be subject to severe climatic conditions, such as hurricanes and thunderstorms.

Fire Fighting Services

The airport fire department is manned by FAA personnel and the station is approximately 3/4 mile away. First alarm response for a structural fire is two engine companies and an ambulance with a total of 7 men. Mutual aid response is from Fairbanks and Lyden Counties.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hr. per day basis with at least one controller on duty at all times. Maximum number of personnel in the tower can at one time be six. Maximum number of personnel in the tower is approximately twenty. Airway facilities personnel are normally on duty during the day shift only. The cab at times can experience visitors, but visitation is kept to a minimum.

Self Inspection

There is no formal self inspection program of significance. The airport fire department makes periodic inspection of the tower. A better means of self inspection is needed.

Emergency Procedures

Written procedures have been established for use in emergency situations covering most natural occurrences. Procedures are not posted.

Security

The ground floor tower entrance is inside the airport terminal. Intercom identification is required before being admitted into the tower. The tower elevator serves the ground floor.

CONSTRUCTION

General Description

The tower (185 ft. in height) is part of the airport terminal building. The building is basically an unprotected steel and concrete building. Upper floors consist of steel deck and concrete on an unprotected steel supports. Ceilings are suspended metal panels with paper covered insulation. The interior core is basically hollow concrete block plastered and painted. Many of the interior partitions are insulated metal sandwich panels. Small windows are provided in the exterior walls. Some walls are also constructed of wallboard on steel studs.

Horizontal and Vertical Fire Separation

The central core runs from the basement to the cab level. Each floor has a cable chase door and power chase door, also a communication core. Most of the interior partitions run up to the underside of the ceiling above. Many of the doors are non rated metal solid core with louvers in some. All the stairs in the stairway are concrete.

Vertical Shafts

The main elevator shaft runs from the ground floor to the eleventh floor. At this floor another elevator runs up to the level under the cab. Elevator walls are hollow concrete block with openings protected by non rated metal doors. There is also a return air shaft for the HVAC units in the mechanical equipment room.

Interior Finishes

There are no unacceptable interior finishes. The majority of the floors have tile or carpeting. Walls are usually painted. Fire characteristics of these materials are not known. Fiberglass insulation wrapped in paper is above the metal suspended ceiling.

UTILITIES

HVAC

Hot water is supplied from the airport system with the boiler located in a separate building. The cab has a separate air conditioning and heating system. The 7-1/2 ton unit is located on the 13th floor in the mechanical room. Also in this room is

another unit to supply the entire 12th floor. The 11th and 10th floors are fed from units on the ground floor, through a ventilation shaft. There are no smoke detectors or fire dampers installed in any of the HVAC units.

Electrical

Electric power is purchased from the local power company. Power to the tower is received at 440 volts, 3 phase, 4 wire. Standby power is from an automatic emergency generator rated at 600 KVA located in a separate building. The generator supplies the emergency load for the entire airport. The control tower elevator is also on the emergency circuit. All electrical wiring is in conduit.

Fire Protection Water Supply

Numerous fire hydrants are in the immediate area of the tower. Mains are mostly 8 and 12 in. with 80 lbs. of pressure. Water is supplied by pumps and reservoir. A 4 in. standpipe is supplied in the stairway. A 2-1/2 inch hose connection and a 1-1/2 inch hose station are provided on each floor.

EXITING FACILITIES

Present exiting from the cab and other tower levels is by means of the center core stairway to the ground floor, then into the main terminal building or through a glass wall into the Ozark waiting area then outside the building. The stairway also leads to the basement where upon exiting from the stairway 60 ft. of corridor have to be traveled to reach an exterior basement stairway door. Essential lighting is all on the emergency power system. Five self contained air packs are presently stored in the cab for emergency use. The untrained use of self contained breathing apparatus by unskilled personnel, as well as the maintenance on them, make their effectiveness questionable.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection consisting of 15 lb. carbon dioxide fire extinguishers. A 4 in. standpipe is provided in the stairway of the tower with 2-1/2 inch hose connections for fire department use on each floor. Also a 1-1/2 inch hose station is provided with 125 ft. of hose combination nozzle. There were no Class A, type fire extinguishers noted at the time of the inspection.

Detection and Alarm System

The majority of the rooms are protected by ionization type smoke detectors with an annunciator panel and test station located in the cab. A manual coded pull station and bell are located in

the cab. A manual coded pull station and bell are located in the stairway core of each level. Alarms are automatically sent to the airport fire station.

Cab personnel also have a direct line to the fire department via a red phone. Another extension can also be used on a separate phone console.

The cab can also use their radio transmitter to talk to fire department personnel in their vehicles.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies of the various levels are as follows:

Cab : Air Traffic Control

13th Floor: Mechanical room

12th Floor: Office area, training room, lounge, coffee room, controller room

11th Floor: Radar and scope room

Basement: Offices, storage room, maintenance room.

Costs for Implementation
of Recommendations

No. 17NF

1.	\$10,000.
2.	\$ 400.
3.	\$ 1,500.
4.	<u>\$ 2,000.</u>
TOTAL	\$13,900.

**REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS**

REPORT NO: 18 NF (Non-FAA)

LOCATION: KANSAS CITY, MO. - MUNICIPAL AIRPORT

SURVEY DATE: JUNE 21, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: EMERSON C. CAPPS - TOWER CHIEF
BOB ETHERTON - CENTRAL REGION
SAFETY MANAGER

CONCLUSIONS

The tower has an adequate fire escape means except that some enclosures would not provide one hours fire resistance. However, by providing an early warning products of combustion detection and alarm system upgrading the deficient enclosures, the emergency egress should be adequate under most conditions.

RECOMMENDATIONS

1. A products of combustion detection and alarm system should be installed throughout the tower including the conduit shaft and stairwell.
2. The conduit shaft needs some improvement to make it more effectively fire and smoke limiting. There is a ventilated door on the shaft on the 4th level which in effect makes an unsealed area. The shaft on the second floor area has holes in the walls and has some wood construction in the shaft.
3. Stairwell enclosure improvements should be made so that the stair shafts would be equivalent to a 1-1/2 hour fire rating. Several of the stairwell access doors have small window sections. Both the 1st and 2nd levels have complete wired glass metal frame doors and walls at the stairwell entrance.
4. Written emergency procedures have not been established. Such a program should be put in force with periodic training and drilling program to be included.

The following items are desirable for a fire-safety protection but are not considered essential to the overall emergency egress program.

A. Fire extinguisher distribution and types are not fully adequate. A Class C type extinguisher should be provided for the Telco room.

This should be equivalent to a 15 lb. CO₂ unit. No Class A units are provided on the 4th and 5th floors where there are office type occupancies. One unit for each floor should be provided equivalent to a 2-1/2 gallon water unit.

B. Poor housekeeping was noted in a few areas and could contribute to a fire emergency. The subfloor space on the Cab level is being used for some miscellaneous combustible storage materials. The conduit shaft area on the 4th floor also has some combustibles in storage. These type materials should be stored in a separate area suitable for combustible storage.

C. Emergency lighting reportedly has been ordered. All due diligence should be taken to have these units installed. This is particularly important for the interior stairwell where no natural light is available.

D. The CO₂ extinguisher on the 4th floor is in doubtful condition. It apparently has not been inspected since 1970. This unit should be serviced and inspection procedures improved so all fire equipment is maintained in good order at all times.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This is an old tower owned and constructed by the City of Kansas City and was the regional airport until the completion of Kansas City International. The airport is located on "bottom land" between the Missouri River on three sides and high ground to the east. The tower is located adjacent to the terminal complex area and is part of a city occupied building. That is, all the ground floor and about half of the second floor is occupied by city facilities. The former terminal facility is over 100 feet distance, however is no longer used as a terminal facility as there are no air carriers from the airport. There are visual flight controls for about a 5 mile radius of the tower. The area could be subject to some flooding, however with the flood control projects established in the last years, this is not a probability. The area could be subject to high wind conditions particularly lightning storms and tornados.

Fire Fighting Services

The entire airport facility is located within the corporate limits of Kansas City, Missouri and receives full public protection. The airport crash station is no longer used and response from downtown Kansas City. The response time is reportedly three to four minutes.

Hours of Operation and Personnel Loading

The tower is operational 24 hours a day with administrative facilities functional from 7:45 AM to 4:15 PM. There is a total employment of about 13. The maximum number on duty is during the day when there are three controllers in the Cab plus the

Tower Chief. The minimum manpower is 1 controller in the Cab from 12:00 midnight to 8 am.

Self Inspection

A through fire-safety inspection is made semi-annually both by the Tower Chief and the Airway Facilities Office. In addition, the tower makes quarterly inspections of the fire extinguishers and housekeeping conditions.

Emergency Procedures

Specific and written procedures have not been established for use in emergency situations.

Security

The door to the stairwell at the entrance lobby is kept locked at all times. The entire terminal building area complex including the tower is open to the public. There is no security fencing on the street side of the terminal area. While local police patrol the area, there are no personnel stationed at the airport. The city however is to provide a 24 hour unarmed security guard in the future.

CONSTRUCTION

General Description

The tower was not designed or constructed by the FAA and was built and is owned by the city. FAA leases the occupied floor areas. The tower consists of 5 floors plus the Cab. The main tower (floors 2 through 5) is a rectangular configuration with a rectangular set-back Cab on the top. The gross floor area for levels 2-5 is 690 sq.ft. and the Cab 530 sq.ft. The FAA does not occupy any part of the first floor. The building is of fire resistant construction and would probably meet 4 hour criteria as defined in NFPA 220. The building is all of masonry construction, mostly reinforced concrete. Some interior partitions and none of the stairwell closures would meet two-hour rating. The Cab is of non-combustible construction consisting mostly of steel with glass in metal framed walls.

Horizontal and Vertical Separation

The stairwell is of complete concrete construction. The stairwell is enclosed on all floor levels, however, the closures are not fully fire resistant. The closure at the bottom of the stairwell (first level) is a complete wired glass in metal frame door and wall. The second floor has similar construction. However, there is a separate stairwell going to the third level of full masonry-metal door construction. The third floor stairwell enclosure has metal doors, not fire rated, in a concrete wall. The 4th and 5th floors are similarly arranged except the metal doors have glazing. The Cab is reached through a separate metal door and a metal staircase. Partitions on the various floors are estimated to be at

least equivalent to a one hour fire hour rating or better. There are no fire doors provided. There are three general types of doors used in the floor partitions. The best is an all metal but not fire rated door, an all metal door with a small ordinary glass metal frame window and a metal door with open louvers for ventilation.

Vertical Shafts

(For stairwell discussion, see the preceding sections. There is no elevator.) The tower has a single shaft utilized principally for electrical wiring in conduit. The shaft also apparently is used for conditioned air ducts, however this could not be definitely ascertained. There were no apparent openings in the shaft other than the metal inspection doors on each floor. However, supply to the various rooms apparently is through the concealed space above the suspended ceilings and its nature could not be ascertained.

Interior Finishes

There are no unacceptable interior finishes. All floors have vinyl tile covering. Suspended ceilings with acoustic tile are provided. The fire characteristics of these materials are unknown.

UTILITIES

HVAC

Heating is provided by a steam boiler owned and operated by city personnel and is located on the first floor. Air conditioning is provided by three units one of which is out of service. The Cab has its own unit located under the raised floor. The third unit supplies floors 3-5. The method of ducting between floors could not be ascertained.

Electrical

Electrical power is supplied by the Kansas City Power and Light Company, a private utility company. There are two supply sources to the airport area for added reliability. Apparently there have not been any outages in the past. There are no known transformers being used, however reportedly the city has some in the basement area. No emergency electrical services are provided.

Fire Protection Water Supply

There is no in tower fire water system. Fire water protection is provided off the city distribution system. Hydrants are located in the area of the tower.

EXITING FACILITIES

There is only one normal egress method, the stairwell. No elevator is provided in the tower. In an emergency, there is one additional method of exiting, an outside ladder system. However, this is

accessible only from the intermediate Cab level. Under adverse weather conditions, this method of exiting could be difficult if not unusable. The tower has no emergency lighting or exit marking. (Battery operated units are on order).

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire equipment only with substandard distribution and types of units provided. The 3rd floor has no Class C unit for the Telco room, the 4th and fifth floors have no Class A units for the office areas. In addition, the 15 lb. CO₂ unit located on the 4th floor is in doubtful condition, apparently was inspected and pressure tested prior to 1970.

Detection and Alarm Systems

None. Public fire fighting facilities would be summoned by a direct line telephone provided in the Cab.

Automatic Extinguishing Systems

None.

OCCUPANCY

The occupancies are unusual for a moderate size tower due to the "outside" design and construction and large amounts of idle space due to the transfer of all air carrier traffic to Kansas City International.

First Floor (No FAA area - ground level) There is access to the stairwell only, for the FAA facilities on the upper levels.

Second Floor (540 sq.ft. net floor area - floor elevation about 10'): Floor is largely unused and was formerly the Tracon room and now being used for misc. excess storage.

Third Floor (540 sq.ft. net floor area - floor elevation estimated 20'): The main occupancy on this level is the Telco room with most of the remainder being empty with minor storage.

Fourth Floor (540 sq.ft. net floor area - floor elevation estimated at 30'): The major area is the Equipment Room with the flight approach control equipment racks and the second occupancy is office space.

Fifth Floor (540 sq.ft. net floor area - floor elevation at 40'): The entire occupancy is essentially office type consisting of the Chief's office, training and ready room and a general purpose area.

Cab Level (500 sq.ft. net floor area - floor elevation estimated about 55'): This is a visual flight control cab with one radar unit.

Costs for Implementation

of Recommendations

(No. 18-NF)

Note: No plans or construction drawings were available for this non FAA constructed tower. Consequently, most of the cost estimating can only be general.

1.	\$5500
2.	\$1000
3.	\$1000
4.	<u>None</u> - procedural only
TOTAL	\$9500

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 19-NF

LOCATION: MILWAUKEE, WISCONSON - MITCHELL FIELD

SURVEY DATE: AUGUST 10, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: BILL CHRISTIAN - FACILITIES MANAGER

CONCLUSIONS

The tower has an adequate emergency egress system with some exceptions. Combustible interior finishes are a hazard. A complete products-of-combustion detection and alarm system with improved compartmentation would provide for an adequate emergency means of egress.

RECOMMENDATIONS

1. A complete products-of-combustion detection and alarm system should be installed in all areas. Smoke detectors should be installed in the air handling unit discharge ducting which will automatically shut down the air handlers upon activation. All alarm signals should automatically be sent to the airport fire station. An annunciator panel should be located in the cab.
2. The plain wood door, at the bottom of the stairway from the cab, should be replaced with a solid core metal fire door and frame together with a door closer.
3. Pressed wood fiber squares should be removed from all areas occupied by FAA.
4. All doors to the rooms on the level under the cab should be replaced with solid core metal rated fire doors and closures.
5. All openings into the cable shaft in the equipment room on the second level under the cab and ground floor should be sealed with noncombustible materials with asbestos cement boards on the outside.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. All of the combustible storage should be removed from the rooms on the level under the cab.

- B. Maintenance should be performed on the fire escape exit doors so that no more than 15 lbs. of force is required to open them.
- C. All combustible storage should be removed from the cable shaft.
- D. Additional exit signs should be installed on the ground level so that the way to an exit is evident.
- E. Additional 2-1/2 gal. water type fire extinguishers should be provided throughout the facility.
- F. There is a need for an improved self-inspection program including providing a check list sheet to be used during the monthly inspection.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower is part of the main terminal complex (first and second floors). The area could be subject to severe summer and winter storms.

Fire Fighting Services

The entire airport facility is located within the limits of the City of Milwaukee and receives full public protection. The airport fire station is located approximately 1/4 mile away and is manned by 4 to 6 firemen, 24 hours a day. Additional equipment responding on a second alarm is 2 engine, 1 rescue and 1 ladder companies which can reach the cab level. All men have air packs. Response time on a second alarm is about six minutes.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hr. per day basis. Maximum number of people in the cab is 5 in addition to 7 maintenance people throughout the tower. Airway facilities personnel are normally on duty during the day shift only. The cab at times can experience visitors, but visitation is kept to a minimum.

Self Inspection

There is no formal self-inspection program of significance. Fire extinguishers are checked monthly by the maintenance people of the tower. Hydrostatic testing is done by an outside contractor.

Emergency Procedures

Written procedures have been established for natural occurrences; however, these are not posted.

Security

The Milwaukee Sheriff's Department has full time personnel assigned to the airport. Proper identification is required before being admitted to the tower.

CONSTRUCTION

General Description

The tower is a non FAA type, level III activity and was constructed in 1952. It is basically a steel framework with concrete floors and roof on metal decking. Outside walls are sandwich insulated panels. Interior partitions are mostly hollow concrete block.

FAA personnel occupy the cab and upper three floors as well as a portion on the ground floor. The remainder of the terminal is occupied by various interests.

Horizontal and Vertical Fire Separation

The main stairway services all floors except the cab. Two metal wired glass non-rated fire doors open into rooms on either side of the stairway.

The outside fire escape is enclosed from the top down to the second level by metal insulated sandwich type panels.

The various rooms on the ground floor have plastered walls and 1-1/2 hr. FM rated fire doors.

Vertical Shafts

The tower has an elevator shaft adjacent to the stairway shaft. The cable shaft is constructed of hollow concrete blocks with openings protected by 1-1/2 hr. B rated fire doors. Also, the cable shaft has open, unsealed penetrations at various levels.

Interior Finish

The majority of the rooms have combustible wood fiber acoustical tiles on the ceilings. Other rooms have suspended ceilings, wood wall paneling and carpeting on the floor. The ground floor has a raised floor with carpeting.

UTILITIES

HVAC

Heating is provided by three separate gas or fuel oil fired boilers in a separate building approximately 1/4 mile away. These boilers furnish heat to the entire airport facility.

Combination air conditioning and heating units serve the tower. Chiller pumps are located in the basement. The ground floor has three air conditioning units with a total cooling capacity of 30 tons for use on cooling the electronic equipment on that level.

Electrical

Electrical power is purchased from the local power company. Power is received through a 3910 KVA transformer, oil filled, and in a separate enclosed vault in the airport complex. Supply is then to two 1000 KVA and one 13.8 KVA dry transformers for tower supply.

Power is 208 volts, 3 phase, 4 wire. Two 125 KVA emergency diesel generators are provided. One generator serves the FAA facility only with the other serving the terminal. All wiring is in conduit.

Fire Protection Water Supply

Fire water is supplied from the city system at 80 psi mostly on 8 in. mains. Numerous hydrants are provided in the terminal area.

EXITING FACILITIES

The internal stairway is the normal means of egress from the tower and exits outside. Two means of egress are available on the ground floor. An alternative means of egress is available for cab personnel, the outside stairs. The access door to outside stairs is on the first landing below the cab. The door is deficient in height. The outside stairway ends on the roof of the terminal building. From the roof an unenclosed fire escape is provided (for two levels) to the ground. The outside stairway doors lock upon closing for security reasons.

Exit lights are provided throughout the building.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection consisting mainly of 15 lb. carbon dioxide fire extinguishers. A few 2-1/2 gal. water-type units are provided. A dry standpipe is also provided in the stairway with a 2-1/2" valve and cap connection on each landing. A siamese connection feeds the standpipe on the ground floor.

There is a deficiency of Class A fire extinguishers throughout the building.

Detection

A pull box, horn and chime are located in the stairway lobby on each floor. Coded signals are received at the airport fire station on tape. An evacuation signal is initiated by the fire department by inserting a key into a pull box in the building.

The cab has a direct line to the airport fire station. Public phones may also be used to call the fire department.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies of the tower are as follows:

Cab: Air traffic control

Fifth level: Equipment room telco room mechanical room, storage rooms, meeting room.

Fourth level: Equipment room, maintenance room, storage room

Third level: Offices

Second level: Terminal occupancy

First level: Terminal occupancy

Costs for Implementation

of Recommendations

NO. 19 NF

1. \$6,000.

2. \$ 200.

3. --

4. \$1,000.

5. 200.

TOTAL \$7,400.

**REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS**

REPORT NO: 20-0 (Type O)

LOCATION: LANCASTER, PA - LANCASTER AIRPORT

SURVEY DATE: JULY 29, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. W. FRITZ

CONCLUSIONS

An enclosed stairway provides the primary means of egress from the tower. Smoke tight facilities are not provided. The installation of a complete products of combustion detection and alarm system throughout the tower and sealing some shaft openings would make the existing means of egress tenable under emergency conditions.

RECOMMENDATIONS

1. An automatic products of combustion detection and alarm system should be installed throughout the tower including the air handling units. This should include automatic shut-down of all air handling units with all fire alarm signals sent to the fire department.
2. All openings from the cable shaft should be sealed with noncombustible materials with asbestos board on both sides.
3. All cable openings on the fifth floor to the cab should be sealed in a similar manner as recommendation No. 2.

The following item is desirable for improving fire-life safety protection but is not considered essential to the overall emergency egress program.

A Class A type fire extinguisher (equivalent to 2-1/2 gal. water unit) should be provided on all levels.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This type O, level I control tower was constructed in 1965 and is located across runways opposite the terminal building. There is no other structure in the area of the tower. Approximately 155,000 flights a year are handled by the tower. The area is not subject to any severe unseasonable climatic condition.

Fire Fighting Services

The City of Lancaster, PA owns the airport which is located in Mannham Township. The airport fire station is located across the runway from the control tower. The response for a fire in the tower would be from Neffsville County Fire department. Equipment would be 2 engine and 1 rescue Company. A ladder of sufficient length to reach the cab can be obtained by mutual aid. Response time is approximately five minutes.

Hours of Operation and Personnel Loading

The tower is operational from 7:00 a.m. to 11:00 p.m., seven days a week. The normal loading in the cab during the daytime is four with the minimum of one at night. Loading below the cab can range from four to none depending on the time of the day. The cab at times can experience visitors, but visitation is kept to a minimum.

Self Inspection

There is no formal self inspection program of significance. Maintenance personnel check all fire extinguishers monthly with an outside contractor doing the hydrostatic testing. Due to the small size of the tower and limited personnel, more elaborate procedures are not required.

Emergency Procedures

General written procedures have been established covering natural occurrences; however, none have been written specifically for this tower.

Security

The ground floor main entrance door is kept locked at all times. Proper intercom identification is required before being admitted to the tower. The tower is not fenced and is accessible to the public.

CONSTRUCTION

General Description

The tower is a Type O, and has five stories and cab, with a pentagon configuration and sloping outside walls. The ground floor gross floor area is approximately 880 sq.ft. of which 210 sq.ft. is used for the stairway. Gross floor area per floor gets progressively smaller on each additional floor but the core stairway remains constant size.

air conditioning, heating units are located in the mechanical equipment room on the fourth floor. One unit serves the cab only with the second unit serving floors 3 and 4 with one room on 5. Ducts have fiberglass, aluminum foil insulation.

Electrical

Electric power is purchased from the local power company. Power is supplied to the tower at 208 volts, 3 phase, 4 wire by buried cables. The main distribution panel is located in the electric room on the first floor. Some conduit is provided in the utility shaft. There is no standby power system at this facility. Batteries provide the power for the solid state equipment. The low voltage telephone equipment is located in a separate room on the first floor. Battery powered emergency lighting units are provided for the stairway.

Fire Protection Water Supply

When the tower was first built a portable 2500 gal. holding tank with a small Peerless pump was provided to supply fire protection water. This was later disconnected due to lift problem with the pump and the outside buried tank. Domestic water is by a well. There is no fire protection water or hydrants provided at this time.

EXITING FACILITIES

The primary means of egress from the tower is by the central stairwell. Four of the six doors that open onto the 1st floor lobby are non-rated fire doors. The other doors that open onto the stairway are 1-1/2 hr. rated fire doors. A secondary means of egress is provided, from the cab by exiting onto an outside catwalk. Egress once on the outside catwalk is by an 8-in. wide metal rung ladder on the exterior of the tower. This is considered a last resort means of egress only.

PROTECTION

Manual Fire Fighting Facilities

Fire extinguishers consist of 15 lb. carbon dioxide units located throughout the tower. The tower has no facilities for fighting a Class A fire.

Detection and Alarm Systems

There are no fire alarm or detection systems. The airport fire station can be summoned by manual actuation of a switch in the cab for a siren on the roof of the fire station. Telephone contact is also possible. Primary notification is by a radio transmitter monitored by the fire department fire command communication center for all the surrounding fire departments. There is no in-tower system for fire notification.

Costs for Implementation

of Recommendations

No. 20-0

1.	\$ 6,200.
2.	\$ 200.
3.	\$ <u>300.</u>
TOTAL	\$ 6,700.

The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, the floors are steel decked with lightweight concrete, exterior walls and partitions are aluminum sandwich type with insulation. The cab has mostly glass exterior walls.

Horizontal and Vertical Fire Separation

All rooms on floors 1 through 4 open onto the central staircase. The rooms on the fifth floor have concrete block walls. The individual rooms on the first to fourth floors open onto the stairway through 1-1/2 hr. B labeled doors with the exception of the storage room on the first floor which is metal, hollow core. Individual rooms on each floor are sub-divided by noncombustible partitions and non-rated metal doors in steel frames.

There are numerous penetrations by ducts and cables from the fifth floor to the cab. Openings exist in the cable chase on both the fifth and third floors.

Vertical Shafts

The center shaft has a concrete floor with hollow concrete block walls running from the ground level to the fourth floor ceiling. Doors off the stairway landings on each level are 1-1/2 hr. B labeled fire doors. The all-metal stairway continues to the fifth floor, then there is a spiral stairway to the cab level.

The tower has two shafts, one a utility shaft and the other a cable shaft. Both shafts go from the first to the fourth floor and are constructed of hollow concrete block with a concrete floor. There is access to the utility shaft on the first floor only, through a small solid core metal door.

The cable shaft, located adjacent to the utility shaft is also constructed of hollow concrete block and terminates on the fourth. Shaft cables penetrate the shaft wall on various floor levels. The cable shaft is accessible on each stairway landing through locked 1-1/2 hr. B labeled fire doors. Open metal grated flooring is provided.

Interior Finishes

Interior finishing is not provided for most wall and ceiling areas. Office and cab areas have carpeting, some with wall paneling. The cab has a suspended ceiling and the office area a plastered ceiling. Fire characteristics of these materials is not known.

UTILITIES

HVAC

A low pressure boiler is provided on the first floor using #2 fuel oil stored in buried outside tanks. An emergency shut-down switch is provided in the lobby on the first floor. Hot water unit heaters are provided in non-office and equipment areas. Two combination

Automatic Extinguishing Systems

None

OCCUPANCY

Occupancies for the various floors are as follows:

1st Floor: (Ground) Equipment room, lavatory, mechanical equipment room, electric panel room, telephone room and storage rooms.

2nd Floor: (Floor elevation, 13'-6") Storage rooms

3rd Floor: (Floor elevation, 22'-10") Equipment rooms, maintenance rooms

4th Floor: (Floor elevation 32'2") Mechanical equipment room, office area, storage rooms

5th Floor: (Floor elevation 40'4") Lavatory, junction room

Cab Level: (Floor elevation 48'-10") Air Traffic Control

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 21-0 (Type O)

LOCATION: MUSKEGON, MICH. - MUSKEGON COUNTY AIRPORT

SURVEY DATE: August 10, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. LEE HOOD, CHIEF AIRWAY FACILITY

CONCLUSIONS

An enclosed stairway provides the primary means of egress from the tower. Smoke tight facilities are not provided. The installation of a complete products of combustion detection and alarm system throughout the tower and improving some enclosures would make the existing means of egress tenable under emergency conditions.

RECOMMENDATIONS

1. Replace the wood door at the top of the stairway leading onto the spiral stairs to the cab with a solid core metal fire door, with wired glass vision panel and door closer.
2. An automatic products of combustion detection and alarm system should be installed throughout the tower including the air handling units. This should include automatic shut-down of all air handling units with all fire alarm signals sent to the fire department.
3. All openings from the cable shaft should be sealed with non-combustible materials with asbestos board on both sides.
4. All cable openings on the fifth floor to the can should be sealed in a similar manner as recommendation No. 3.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. At the time of the inspection, the tower was in the process of having 3 regular and 1 maintenance scopes installed. Many of the storage and equipment rooms had a considerable amount of combustible storage and crating. No smoking signs should be posted in these areas until combustibles are removed.

B. A Class A type fire extinguisher (equivalent to 2-1/2 gal. water unit) should be provided on all levels.

C. Additional battery powered emergency lighting units should be provided on each level.

D. The trash trailer should be relocated at least 25 ft. from the tower.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This Type O, level II control tower was constructed in 1967 and is located approximately three blocks from the terminal building. The tower is off from the runways. There is no other structure in the immediate area. There is access to the tower from all sides.

Fire Fighting Services

The security personnel are also the airport firemen. The combined police and fire station has a foam truck only. Normal personnel on duty per shift is two. No one is there at nights. The airport firemen do not have self-contained breathing apparatus. At night, fire protection is provided by Norton Shore, which is a combination paid and volunteer fire department. Norton Shore does not have any ladders capable of reaching the cab level.

Hours of Operation and Personnel Loading.

The tower is operational 24 hours a day, seven days a week. The normal loading in the cab during the daytime is 4 to 7 with the minimum of 1 at night. Loading below the cab can range from ten to none depending on the time of day. The cab at times can experience visitors, but visitation is kept to a minimum.

Self Inspection

There is no formal self inspection program of significance. Maintenance personnel check all fire extinguishers monthly with an outside contractor doing the hydrostatic testing. Due to the small size of the tower and limited personnel, more elaborate procedures are not required.

Emergency Procedures

General written procedures have been established covering natural occurrences; however, none have been written specifically for this tower. Procedures are not posted.

Security

The ground floor main entrance door is kept locked at all times. Proper intercom identification is required before being admitted

to the tower. The tower is not fenced and is accessible to the public off an access road.

CONSTRUCTION

General Description

The tower is a Type O, and has five stories and cab, with a pentagon configuration, and sloping outside walls. The ground floor gross floor area is approximately 880 sq.ft. of which 210 sq.ft. is used for the stairway. Gross floor area per floor gets progressively smaller on each additional floor but the core stairway remains a constant size.

The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, the floors are steel decked with lightweight concrete, exterior walls and partitions are aluminum sandwich type with insulation. The cab has mostly glass exterior walls.

Horizontal and Vertical Fire Separation

All rooms on floors 1 through 4 open onto the central staircase. The rooms on the fifth floor have concrete block walls. The individual rooms on the first to fourth floors open onto the stairway through 1-1/2 hr. B labeled doors. Individual rooms on each floor are sub-divided by noncombustible partitions and non-rated metal doors in steel frames.

There are numerous penetrations by ducts and cables from the fifth floor to the cab. Openings exist in the cable chase on both the fifth and third floor.

Office areas on the various floor have drywall on steel stud partitions and 1-1/2 hr. B rated fire doors. All partitions end just above the suspended ceiling.

Vertical Shafts

The center shaft has a concrete floor with hollow concrete block walls running from the ground level to the fourth floor ceiling. Doors off the stairway landings on each level are 1-1/2 hr. B labeled fire doors. The all-metal stairway continues up to the fifth floor, then there is a spiral stairway to the cab level.

The tower has two shafts, one a utility shaft and the other a cable shaft. Both shafts go from the first to the fourth floor and are constructed of hollow concrete block with concrete floors. There is access to the utility shaft on the first floor only, through a small solid core metal door.

The cable shaft, located adjacent to the utility shaft is also constructed of hollow concrete block and terminates on the fourth. Shaft cables penetrate the shaft wall on various floor levels. The cable shaft is accessible on each stairway landing through locked 1-1/2 hr. B labeled fire doors. Open

metal grated flooring is provided.

Interior Finishes

Interior finishing is not provided for most wall and ceiling areas and hollow concrete block. Office and cab areas have carpeting, some with wall paneling. The cab and office have suspended ceilings. Fire characteristics of these materials is not known.

UTILITIES

HVAC

A 40 H.P. low pressure boiler is provided on the first floor using natural gas with the meter located outside. An emergency shut-down switch is provided in the lobby on the first floor. Hot water unit heaters are provided in non-office and equipment areas. Two combination air conditioning, heating units are located in the mechanical equipment room on the fourth floor. One 10 ton unit serves the cab only with the second unit serving floors 3 and 4 with one room on 5. Ducts have fiberglass, aluminum foil insulation. Small combination cooling and hot water heating units are installed at various locations throughout the tower.

Electrical

Electric power is purchased from the local power company at 4160 volts. Power is supplied to the tower at 208 volts, 3 phase, 4 wire by buried cables. The main distribution panel is located in the electric room on the first floor. Some conduit is provided in the utility shaft. There is no standby power system at this facility. Batteries provide the power for the solid state equipment. The low voltage telephone equipment is located in a separate room on the first floor. Battery powered emergency lighting units are provided for the stairway.

Fire Protection Water Supply

One fire hydrant is located within 100 ft. of the tower with another one approximately 2 blocks away. Mains are 6 in. with 80 psi static. There are no sprinklers or standpipes in the tower.

EXITING FACILITIES

The primary means of egress from the tower is by the enclosed central stairwell. All doors that open onto the stairway are 1-1/2 hr. rated fire doors. A secondary means of egress is provided from the cab by exiting onto an outside catwalk. Egress once on the outside catwalk is by two 8 in. wide metal rung ladders on the exterior of the tower. Effectiveness of this ladder system in an emergency situation is questionable. A cage is provided at the top of the ladder only.

PROTECTION

Manual Fire Fighting Facilities

Fire extinguishers consist of 15 lb. carbon dioxide units located throughout the tower. The tower has no facilities for fighting a Class A fire.

Detection and Alarm System

Firemen are summoned by a siren on top of the fire station which can be activated from the cab. There is also a red phone direct connection to the fire station.

Automatic Extinguishing Systems

None

OCCUPANCY

Occupancies for the various floors are as follows:

1st Floor: (ground) Equipment room, lavatory, mechanical equipment room, electric panel room, telephone room and storage rooms.

2nd Floor: (Floor elevation, 13'6") Office areas.

3rd Floor: (Floor Elevation, 22'-10") Equipment rooms, storage rooms, offices.

4th Floor: (Floor Elevation, 32'2") Mechanical equipment room, office area, storage rooms

5th Floor: (Floor Elevation, 40'4") Lavatory, reading room, recorder room, equipment room

Cab Level: (Floor Elevation 48'-10") Air Traffic Control

**Costs for Implementation
of Recommendations**

No. 21-0

1.	\$ 200.
2.	\$ 6,200
3.	\$ 200.
4.	\$ <u>300.</u>
TOTAL	\$ 6,900.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 22-0 (Type 0)

LOCATION: SAN DIEGO, CA - LINDBERGH FIELD

SURVEY DATE: JUNE 10, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: DICK WHITE - ASSISTANT CHIEF

CONCLUSIONS

The tower has a noncombustible internal escape means (stairwell). An escape hatch to the 4th floor roof from the 5th floor provides access to 2 escape ladders of inadequate size and design. A rope and sling system is also available for use from the 4th floor roof (only). The cab has an escape hatch onto the roof, then depending on outside help for removal. (Time requirements and reliability make all of these last resort procedures). Provisions for improving smoke confinement and the installation of a products of combustion detection and alarm system would provide for an adequate emergency egress system.

RECOMMENDATIONS

1. An automatic products of combustion detection and alarm system should be installed throughout the tower including the air handling units. This should include automatic shut-down of all air handlers.
2. All openings from the cable shaft to other areas or rooms should be sealed in a manner to be equivalent to 1-1/2 hr. fire resistance rating and be smoke tight. This should include the openings in the 5th floor.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. A Class A type fire extinguisher (equivalent to 2-1/2 gal. water unit) should be provided on the 2nd and 3rd floors.
- B. The electric transformer located in the 1st floor Mechanical Equipment Room should be relocated outside and at least 25' from the tower structure.

C. All telephones should have emergency call numbers listed in the immediate area.

D. The Telco Room was being used to store some combustible materials. This material should be stored in a "non-operational" area.

E. There is a need for an improved self-inspection program including providing a check list sheet to be used during the monthly inspections.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became operational in 1967 and is located on flat terrain between hills to the east and the ocean to the west. The tower is located on the edge of the airport across the runway complex opposite the terminal facility. The tower is located fairly close to the main runways but is not considered unduly close. The tower excercises flight control over an approximate 5 mile radius of the tower. The area is not subject to any severe climatic conditions, but is subject to earthquake hazards. The only other structure in the immediate area is the airport fire station some 200 ft. distance.

Fire Fighting Services

The tower and airport facility are located within the limits of the city of San Diego and receive full public protection. The airport "crash" fire station is located adjacent to the tower. This station has no equipment that can reach the cab level of the tower. Such equipment would be available from the main fire station located in the main business district and would be available in about 5 minutes. The cab is equipped with a hot-line telephone with direct connections to all emergency offices of the city.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hour per day basis with at least one controller on duty at all times. There is a total employment of about 20. The main activity is day time when the normal load is 5 in the cab, 2 on the 3rd floor, 6 on the 2nd floor and 2 on the 1st floor. Airway Facilities personnel are normally on duty during the day shift only. The normal shift load is 12 daytimes, 6-7 evenings and 1 at night. The cab at times can experience visitors, but visitation is kept to a minimum.

Self Inspection

There is no formal self inspection program of significance. There is an annual in tower inspection for fire and safety hazards. Fire extinguishers are checked and serviced as required on an annual basis also. Due to the small size of the facility and limited personnel, more elaborate procedures are not required.

Emergency Procedures

Written procedures have been established for use in emergency situations. These cover most natural occurrences in addition to fire related malfunctions. While procedures are not "posted", personnel reportedly are familiar with their duties in an emergency.

Security

The ground floor main entrance door is kept locked at all times. Proper intercom identification is required before being admitted to the tower. In addition, an airport woven wire fence system encloses the tower and environs. The access gate to the tower area is also locked at all times and can be opened from the cab after proper intercom identifications.

CONSTRUCTION

General Description

The tower is type "O" modified with 5 stories plus cab building with pentagon configuration, sloping walls and a set-back 5th floor and cab. Thus the floor areas vary from an approximate gross (including the central core) area of 1500 sq.ft. for the 1st floor to 1050 sq.ft. for the 4th floor. The set-back floors have areas of 400 and 480 sq.ft. for the 5th and cab levels respectively. Floors 1 through 4 each have a vertical central core area of 225 sq.ft. housing the utility and cable shafts and the staircase. The central core is constructed of concrete blocks.

The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are poured concrete on steel pans and the cab roof consists of a steel deck. Exterior walls are of steel panels apparently of an insulated sandwich construction. The cab walls are mostly tempered glass in steel frames. Interior partitions are of noncombustible construction essentially plaster on metal studs. Ceilings are open with the exception of the cab which has suspended mineral board lay-in tiles on steel frames.

Horizontal & Vertical Fire Separation

All rooms or areas on Floors 1 through 4 open onto the central staircase which is an open shaft from the 1st to the 5th floor. The 5th floor rooms are separated from the stairwell by a single 1-1/2 hr. rated fire door with pneumatic closure. The individual rooms on floors 2 through 4 opening directly into the stairwell shaft are equipped with 1-1/2 hour rated fire doors with pneumatic closures. The 1st floor rooms all have non fire rated metal clad solid core doors with steel frames. The stairwell has an all steel staircase. The individual rooms on each floor are all separated by noncombustible partitions with nonrated metal doors where there are partition openings (minor). Floors 2 through 4 consist of two equal separate fire areas. Floors 1, 5 and the cab are essentially single fire areas.

Vertical Shafts

(For stairwell discussion, see the preceding section. There is no elevator shaft).

The tower has 2 shafts or chases. One is for electrical and signal wiring and cables, etc. and the second is for utility piping and HVAC systems. Both these shafts are open from the 1st to the 5th floors. The cable shaft has open (unsealed) penetrations into room areas on most floors and particularly the 5th floor which has ceiling openings to the cab and floor openings from the shaft below. The wiring in the shaft is mostly in conduit, with some open PVC wiring. The cable shaft has 1-1/2 hr. rated fire doors (no automatic closures but normally closed and locked) for access on each floor. The utility shaft has no unsealed openings to any floor except the 5th. There is an unrated metal access door on the 1st floor.

Interior Finishes

There are no unacceptable interior finishes. Floors have carpeting and vinyl tile in nonmechanical-utility areas (i.e. offices, training rooms, cab., etc.). Fire characteristics of these materials are unknown. Suspended ceilings are provided in some areas (See General Description).

UTILITIES

HVAC

Heating is provided by an UL labeled gas-fired hot water heater (boiler) equipped for full automatic operation including adequate combustion safeguards, except no double block and bleed assembly is provided on the fuel gas supply. Hot water is piped to other floors via the utility shaft.

An air conditioning unit is located on the 4th floor. No details were available on the distribution system. Apparently, the main distribution is to the 5th and cab levels supplied through an open 5th floor duct and open duct areas to the cab. There is no smoke travel impediment from the 4th to 5th to cab levels. Floors 1 through 4 apparently are not air conditioned.

Electrical

Electrical power is purchased from the San Diego Gas & Electric Company (city owned). Power is received at 4160 volts and reduced to 208/110 by a 100 kva transformer on the 1st floor. Distribution is from the first floor main distribution panel to the cable shaft for distribution to all floors some through unprotected openings. There is an automatic starting 37.5 KVA diesel engine driven emergency generator provided which can supply essential requirements in case of a power outage. An outside buried fuel tank is provided. Power wiring is mostly in conduit with other wiring open. The telephone room (TELCO) is also located on the 1st floor. This equipment is all low voltage.

Fire Protection Water Supply

There is no in tower fire water system. Airport fire water protection is provided from the city of San Diego water distribution system. A fire hydrant is provided in the tower area.

EXITING FACILITIES

The stairwell is the only normal egress method as there is no elevator. The stairwell should be fire and smoke safe for a reasonable egress time with two exceptions. There are unsealed openings in the cable shaft. (Opening the emergency egress outside door on the 5th floor, to the 4th floor roof would offer some natural venting to the outside). Secondly, assuming all room doors are kept closed. In an emergency, there will also be available two outside ladders and two rope and sling units. The ladders are accessible from the 4th floor roof. The access door is in the exterior wall. It is necessary to pass thru the top staircase landing to reach the access door. The ladders are located about 25 feet apart and are substandard size having a 6" step spacing and are 8" wide. It would also be necessary to use the rope and sling system from the 4th floor roof. Essential lighting is all on the emergency power system. There is no exit signing.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of 15 lb. CO₂, 20 lb. dry chemical and 2-1/2 gallon water fire extinguishers. There is a deficiency of Class A units, in the office occupancy floors.

Detection and Alarm Systems

NONE. The San Diego fire department would be summoned by a direct line in the cab and dial telephones from other tower areas. In-tower (other than in the cab) procedures for transmitting alarms is not clearly established.

Automatic Extinguishing Systems

NONE.

OCCUPANCY

Occupancies are typical of a small tower and consist of:

1st Floor (1275 sq.ft. net floor area - ground level):
Mechanical equipment room (the largest and main area) which contains essentially a hot water heater, electric transformer, and incoming electrical distribution power panels, emergency generator and small air compressor; Telco Room-telephone switch gear and wash room.

2nd Floor (1075 sq.ft. net floor area - floor elevation 13'6"):

Consists of approximately 2 equal areas occupied as the Training Room and a Store Room mainly empty and is to be converted to office space.

3rd Floor (935 sq.ft. net floor area - floor elevation 22'10"): Is about equally divided between the Radio Equipment Room and the Tower Chief's office.

4th Floor (825 sq.ft. net floor area - floor elevation 32'2"): Is about equally divided between the Ready Room and Mechanical Equipment Room which houses the air conditioning equipment.

5th Floor (150 sq.ft. net floor area - floor elevation 40'4"): Has the Junction Room (electrical wiring etal from cable shaft for distribution to the cab level) and a small water closet.

Cab Level (480 sq.ft. net floor area - floor elevation 48'10"): Radio and radar (one set) control over an approximate 5 mile radius.

Costs for Implementation

of Recommendations

(No. 22-0)

1. \$5000

2. \$ 250

TOTAL \$5250

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 23-P (Pei)

LOCATION: LOUISVILLE, KY

SURVEY DATE: AUGUST 5, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: WILBURN MOODY, ASST. TOWER CHIEF

CONCLUSIONS

Although the tower is basically a fire resistant building, it has certain deficiencies that need to be corrected to ensure safe means of egress. A fire in first floor office area would expose the cab to smoke via the above ceiling dead space and the cable or ventilation shafts. Outside access from the tower stairway is not protected from first floor occupancies. The installation of products of combustion detection and alarm system, sealing penetrations and upgrading partitions should make for an adequate emergency egress system.

RECOMMENDATIONS

1. The plain glass partition wall separating the office occupancies from the hallway of the tower should be replaced with a 1 hr. rated fire partition with the opening protected by 1 hr. rated fire doors and closers.
2. A complete automatic products of combustion detection and alarm system should be installed throughout the tower and office building, including mechanical and equipment rooms. Detectors should also be installed in air handling units designed to automatically shut down the unit upon activation. All alarms should be sent automatically to the airport fire station.
3. Cable penetrations of the cab floor, junction room floor, and penetration of the cable and stairway enclosures should be sealed with noncombustible materials with asbestos board covering on each side.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. A clear path should be maintained through the training room

from the corridor to the exterior door so that it may be used as an emergency secondary means of egress from the office occupancy.

B. Personnel lockers and clothes racks should be removed from the exit corridor on the ground floor of the office occupancy.

C. The elevator should be tied into the fire alarm system and arranged to respond automatically to the first floor upon a fire alarm actuation for use by the fire department.

D. Additional Class A type fire extinguishers (equivalent to 2-1/2 gal. water unit) should be provided throughout the equipment areas, tower stairway and cab.

E. Exit signs should be provided on the ground floor in areas where the exit is not obvious, such as through the training room.

GENERAL ASPECTS

Site Features, Conditions and Exposures

This level III tower became operational in 1970 and is located on the opposite side of the airport and across from the runways from the terminal area. The tower has been abandoned in the past because of approaching tornados, some of which have touched down at the airport. There are no structures in the immediate area that expose the tower.

Fire Fighting Services

The airport is within the City of Louisville, KY and in Jefferson County. The airport fire station is located approximately 300 ft. away from the tower. Response is seven men and a tanker and pumper. The alarm also goes to fire department headquarters which sends additional equipment on the first alarm. City response time is around five minutes.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hr. per day basis. Maximum number of personnel in the cab at one time is five with 11 personnel in the I.R.F. room. Total number of personnel in the tower and office area is 48. Normal personnel during the daytime in the office is around 20. Maintenance personnel occupy the tower only during the daytime.

Self Inspection

There is no formal self inspection program of significance. The maintenance personnel of the tower inspect the fire extinguishers on a monthly basis. Hydrostatic testing of fire extinguishers is by an outside contractor.

Emergency Procedures

Written procedures have been established for use in emergency situations. These cover most natural occurrences in addition to fire related malfunctions. Procedures are not posted.

Security

The ground floor main entrance door is kept locked at all times. Proper intercom identification is required before being admitted to the tower. Proper identification is also required to gain entrance into the airport grounds. A guard station is provided at the airport entrance.

CONSTRUCTION

General Description

The tower is a Pei type with a pentagon configuration and is approximately 70 ft. high from the basement to cab level. The walls near the top slope outward. The tower has a large one-story non-combustible base building which is used by the radar people and various other support groups for the tower. Floor areas around the center core of the tower have approximately 340 gross sq.ft. (larger near the top). The central core consists of ventilation, communication and control cable shafts, elevator, and a metal staircase.

The tower is of fire resistive construction as defined in NFPA 220 with both exterior and interior walls, floors and ceiling of reinforced concrete construction. Some upper area rooms have plaster and steel studs partitions.

The base building is of noncombustible construction with exposed steel roof, hollow concrete block walls and steel studs and wall-board partitions and concrete floor. A eight-room noncombustible addition was added to the base building in 1975.

Horizontal and Vertical Fire Separation

Many of the rooms on the first floor are not effectively cut off and communicate with each other due to cable openings, nonsealed openings, etc. The ground floor area can basically be regarded as one fire area. Wood doors are provided in office areas.

Vertical Shafts

The main vertical shaft has concrete walls and encloses the metal stairway running from the basement to the level below the cab. An exhaust shaft serving the cab only is sealed down to the ground floor. 1-1/2 hr. Class B UL labeled fire doors protect openings in the communication and cable shafts.

Fire rated access doors are provided at the top of the elevator shaft. The elevator shaft goes from the ground floor and terminates on the second level down from the cab.

Interior Finishes

Office area floors are carpeted and have wood wall paneling. Vinyl tile floor covering is used in areas not carpeted. Suspended ceilings are used in nonequipment areas.

UTILITIES

HVAC

Heating is provided by a 40 H.P. low pressure steam boiler located in an equipment room on the ground floor. Buried fuel oil (No. 2) tanks are provided.

Two airhandling units are also located in the boiler room. One unit serves the cab only with the other unit serving the remainder of the tower and base building. Two emergency exhaust fans are provided serving the cab only.

Small space heaters are provided in the stairwell. Domestic hot water is supplied by an electric heater of 30 gal. capacity.

Electrical

Electric power is purchased from the local power company. 13 KW buried supply lines feed the transformer cubical (open at the top and fenced on two sides and bricked on the other two sides). The oil filled transformer is located approximately 12 ft. from the based building wall. Supply voltage to the tower is 208 volts, 3 phase, 4 wire. The main breaker for the tower is located in the emergency generator room.

Emergency power is supplied by one 125 KVA diesel emergency generator. The emergency generator does not supply non-essential users such as the elevator and air conditioners. Essential power panels have their loads transferred automatically via transfer switches to the emergency generator circuit. Diesel fuel supply oil is from a buried outside 1000 gal. tank. Power wiring is mostly in conduit.

Fire Protection Water Supply

One fire hydrant is located within 50 ft. of the tower. Water mains are mostly looped 6 in. Water is supplied by City of Louisville system at about 65 psi static pressure. A water test in 1973 produced a flow of 2000 gpm at 20 psi.

EXITING FACILITIES

Normal exiting from the tower cab is by the use of the stairway or by the elevator. Any fire on the ground floor will produce smoke and toxic gases throughout the stairwell which is open on the first floor. The elevator is also exposed on the first floor again due to cable penetrations in the stairway. There is no exterior ladder at the tower.

All lighting is supplied by the emergency generator circuit. There are no separate exit lights at the facility.

PROTECTION

Manual Fire Fighting Facilities

First aid fire protection consists mostly of 15 lb. carbon dioxide fire extinguishers. Three 2-1/2 gal. soda-acid extinguishers are provided on the ground floor. There is a deficiency of Class A units throughout the tower and equipment areas.

Detection and Alarm Systems

None. The cab in the tower has a direct line to the fire department. This is also tied into the Louisville fire alarm system. All regular phones can also reach the fire department. The cab can also call the fire department with the radio transmitter which the fire department monitors 24 hours a day.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies for the tower are as follows:

First Floor - Ground floor: mechanical rooms, equipment rooms, radar room, offices, toilets, lobby reading room, meeting rooms, elevator.

Second Floor - Stairway

Third Floor - Stairway

Fourth Floor - Elevator equipment room

Cab - Top of tower

Costs for Implementation

of Recommendations

No. 23-P

1.	\$ 1,700.
2.	\$ 10,500.
3.	<u>600.</u>
TOTAL	\$ 12,800.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 24-P (Pei)

LOCATION: WASHINGTON, D.C. - ANDREWS AFB

SURVEY DATE: AUGUST 2, 1976

SURVEYING ENGINEER: JAMES D. BEHN

FAA PERSONNEL CONTACTED: MR. ROBERT HANS - TOWER CHIEF

CONCLUSIONS

Although the tower is basically a fire resistant building, it has deficiencies that need to be corrected to ensure safe means of egress. A fire on the first floor would expose the stairway. Fully enclosing the stairway on the first floor and adding an outside exit door for the stairwell egress and the installation of products of combustion detectors would provide an adequate emergency means of egress from the tower.

RECOMMENDATIONS

1. A 1 hr. rated enclosure assembly should be provided for the stairway on the first floor. This should include fire doors, with closers, for openings into the stairway.
2. A new exit door should be provided at the bottom of the stairwell on the ground floor in the exterior wall. This door should be a 1-1/2 hr. D rated exterior fire door and closure.
3. An automatic products of combustion detection and alarm system should be installed throughout the tower and office area including the air handling units. Air handling units should shut down upon actuation of a detector. All fire alarm signals should automatically be sent to the airport fire station.
4. Cable openings in the floor and ceiling, of the equipment room below the cab, and in the radar room should be sealed with non-combustible materials with an asbestos cement board covering.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. All cab personnel should receive training in the use of self contained air packs if these units are to be of any value.

- B. Class A fire extinguishers (equivalent to 2-1/2 gal. water unit) should be provided throughout the office area, tower stairway, and cab.
- C. Remove the plastic combustible supplies from the electrical closet on the second floor.
- D. All combustibles and flammable liquid storage should be removed from the air intake tunnel on the ground floor.
- E. Exit signs should be provided on the ground floor in areas where the way to reach an exit is not obvious.
- F. Pressed wood fibre tiles should be removed from the radar room on the first floor.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower became occupantional in 1967 and is located next to the beltline road on the outskirts of Washington, D.C. There are no commercial flights. The tower is located near the corner of the runways and only handles military traffic.

The area could be subject to high winds and summer lightning storms. The tower and base building are not exposed by any structure.

Fire Fighting Services

The tower is located on Andrews Air Force Military Base and has its own fire department consisting of air force military personnel. The fire station is located approximately 1/2 block from the tower. The fire department has special keys to use the elevator in an emergency. The fire department would respond with one 750 gal. pumper, one 500 gal. pumper and a rescue unit. Total personnel responding on the first alarm is a minimum of 13. George County responds on mutual aid and brings with them only equipment requested.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hr. per day basis. The maximum number of personnel in the cab at one time is 7 with 6 personnel in the I.R.F. room. Total number of personnel in the tower and base building is 25.

Self Inspection

There is no formal self inspection program of significance. The base fire department inspects the tower on a quarterly basis with the maintenance personnel of the tower inspecting the fire extinguishers on a monthly basis. Due to the fire department inspection, a more elaborate program is not necessary.

Emergency Procedures

Written procedures have been established for use in emergency situations. These cover most natural occurrences in addition to fire related malfunctions. Procedures are not posted.

Security

The ground floor main entrance door is kept locked at all times. Proper intercom identification is required before being admitted to the tower. Identification is also needed to get into the AFB.

CONSTRUCTION

General Description

The tower is Pei type, Level III of pentagon configuration and approximately 125 ft. high from basement to cab level. The exterior walls near the top slope outward. At the base of the tower a large one-story noncombustible building (so called Base Building) is used by the radar people and various other support functions for the tower. Gross floor areas around the core of the tower are approximately 340 sq.ft. (larger near the top). The central core consists of ventilation chase, communication chase, control cable chase, elevator and a metal staircase.

The tower is of fire resistive construction as defined in NFPA 220 with exterior and interior walls and floor of reinforced concrete construction. Some upper area partitions are steel studs with lath and plaster construction.

The base building is of noncombustible construction with exposed steel roof and hollow concrete block walls, steel studs and wallboard partitions.

Horizontal & Vertical Fire Separation

Many of the rooms on the first floor have unprotected openings between them due to cable openings and nonsealed openings. The ground floor area can basically be regarded as one fire area. The area also communicates with the open tower stairway. Many of the doors on the first floor are metal clad solid core doors with steel frames. Offices have wood doors.

The cab and junction level are also basically one fire area.

Vertical Shafts

The main vertical shaft has concrete walls and encloses the metal stairway running from the basement to the junction level. An enclosed exhaust shaft serving the cab only is provided from the ground floor. On each level to the stairway a 3 in. by 3 ft. exhaust openings is provided in the wall and terminates on the ground floor HVAC room. Locked 1-1/2 hr. Class B labeled fire doors protect the communication and cable shaft openings. The communication and cable shafts communicate with each other. Elevator service terminates at the 14th level.

Interior Finishes

Offices have carpeting and wood wall paneling. Vinyl tile is used in areas not covered by carpeting with suspended ceilings used in nonequipment areas.

UTILITIES

HVAC

Heating is provided by a 50 H.P. boiler located in an equipment room on the ground floor. Number two fuel oil is used and stored in outside buried tanks.

Two air handling units are also located in the boiler room. The unit serves the cab only with the other unit the remainder of the tower and office area. Two emergency exhaust fans for the cab only are located above the ceiling in the cab.

Small space heaters supply the heat for the stairway itself. Domestic hot water is supplied by electric hot water heater.

Electrical

Electric power is purchased from the local power company. There is an underground electrical supply at 13.3 kv to a buried concrete transformer vault (open at top with grating and lock). The oil filled transformer is located approximately 50 ft. from the tower. Secondary voltage to the tower is at 208 volts, 3 phase, 4 wire. The main breaker for the tower is located in this transformer vault. Electrical wiring is mostly in conduit. Power supply to the tower is through distribution panels located in the electrical room on the ground floor.

Emergency electrical power is supplied by two 75 KVA diesel engine driven generators. None of the non-essential users are supplied by the emergency generators. Essential power and lighting loads are transferred automatically via transfer switches to the emergency generator circuit. The diesel oil is stored in outside buried tanks.

Fire Protection Water Supply

Two hydrants are located within 150 ft. of the tower. Water mains are mostly looped 8 in. supplied by a gravity tank that floats on the system maintaining 40 psi static pressure on the system.

EXITING FACILITIES

Normal exiting from the tower cab is by the stairway or elevator. Any fire on the ground floor will expose the upper levels to smoke and toxic gases since the stairway is open on the first floor. The 1st floor elevator lobby is not smoke tight. There is no exterior ladder system at the tower and the fire department does not have facilities to reach the cab level.

The nine self contained breathing units with a 15 minute supply of air, are kept in the cab. Personnel are not trained in their use.

All normal lighting is supplied by the emergency generator. No exit sign lighting is provided.

PROTECTION

Manual Fire Fighting Facilities

First-aid fire protection consists mostly of 15 lb. carbon dioxide fire extinguishers with a multi-purpose dry chemical extinguisher in the cab. A metal fire hose cabinet is located in the hallway on the ground floor with 1-1/2 in. rubber hose and combination nozzle. A small booster pump with a discharge pressure of 60 psi supplies this hose station as well as domestic service.

Detection and Alarm Systems

None. A battery powered home type ionization detector is provided for at the doorway of the equipment on the first floor. The cab has a direct line to the airport fire station. All other phones have the fire department call number posted. The cab can also call the fire department with the radio transmitter which the fire department monitors 24 hours a day.

Automatic Extinguishing Systems

None.

OCCUPANCY

Occupancies for the tower are as follows:

1st Floor (ground level): Equipment room, mechanical room, emergency generator room, electrical room, toilets, janitors room, radar room, reading room, various offices, lobby, telco room.

2nd Floor: elevation 7', cable access

3rd Floor: elevation 14'6". electrical closet

4th Floor: elevation 22'6", cable access

5th Floor: elevation 30'6"

6th Floor: elevation 37'6", cable access

7th Floor: elevation 45'0"

8th Floor: elevation 52'6"

9th Floor: elevation 60'0", elevator landing

10th Floor: elevation 67'6"

11th Floor: elevation 75'0"
12th Floor: elevation 82"6"
13th Floor: elevation 90'0"
14th Floor: elevation 97'6", top elevator landing
15th Floor: elevation 106'6", transfer space
16th Floor: elevation 112'11", junction space, storage, toilet
17th Floor: elevation 121'10", control cab

Costs for Implementation
of Recommendations

No. 24-P

1. \$ 1,200.

2. \$ 500.

3. \$ 10,500.

4. \$ 400.

TOTAL \$ 12,600.

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 25-SRD (Southern Region Design)
LOCATION: MIAMI, FLORIDA - NEW TAMiami AIRPORT
SURVEY DATE: JUNE 15, 1976
SURVEYING ENGINEER: JOHN L. CARLSON, P.E.
FAA PERSONNEL CONTACTED: JESSE MOTON - TOWER CHIEF

CONCLUSIONS

The noncombustible stairwell is not fully enclosed and would be exposed to smoke and fire in an emergency. With the installation of an early warning detection and alarm system, sealing shaft penetrations and enclosing the cab staircase accessway the egress system would be adequate in an emergency.

RECOMMENDATIONS

1. An automatic products of combustion detection and alarm system should be installed throughout the tower.
2. The cable shaft should be completely sealed on the 7th floor to prevent smoke from entering the 7th and Cab levels, under fire conditions.
3. An enclosed accessway (equivalent to 1 hr. fire rating) should be provided from the bottom of the cab staircase to the tower stairwell. A 1 hr. equivalent fire door with closer should be provided for egress from the equipment room.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program.

- A. The tower lacks adequate storage facilities as a consequence many operational areas are crowded with miscellaneous combustible storage materials which make for improper segregation of fire hazards.
- B. A leaky roof causes a potentially slipping hazard in the stairwell areas under wet weather conditions.
- C. There are no Class A type fire extinguishers provided in the tower. One unit (equivalent to a 2-1/2 gallon water unit) should be provided on the second floor where a make-shift office area has been established in the Telco room, fifth floor office area, sixth floor Ready Room area and the Cab.

D. The exhaust piping from the diesel engine should be rearranged so the air conditioning units could not intake the exhaust fumes while the engine is operating. It is reported that the fumes are noticeable even at the cab level when the engine is operating.

E. A self-inspection program should be provided to check all fire and safety facilities of the tower on a periodic basis, preferably on a monthly basis, but at least semi-annual.

GENERAL ASPECTS

Site Features-Conditions and Exposures

The tower is located on flat terrain in southern Florida. This is a general aviation facility and there is no commercial carriers or traffic. The tower is located on one side of the field with the general aviation facilities. The area is subject to severe climatic conditions at times, consisting essentially of heavy rainfalls and hurricane velocity wind conditions. The closest structure to the tower is the fire station about 100 feet distance. Other exposures consist of a 20,000 gal. LP gas vessel @ 100' and other buildings at 100-200'. All are constructed of noncombustible materials.

Fire Fighting Services

The airport is located in an unincorporated area of Dade County and receives full County Fire Department response. The adjacent fire station is staffed by joint police-firemen. The fire department is staffed by police department personnel. There is no equipment available for personnel removal from the upper elevations of the tower. A helicopter is stationed here, however, it has no equipment for removing of personnel from structures.

Hours of Operation and Personnel Loading

The tower is operational from 7 AM to 11 PM with at least 3 controllers on duty at all times. There is a total employment of about 20. Main activity is daytimes when there are 5 on duty. The normal personnel load is entirely in the cab, occasionally with one or two in the chief's offices on the fifth floor.

Self-Inspection

There is no self-inspection program at the tower. The Port Authority (fire department) makes semi-annual inspections on an advisory basis.

Emergency Procedures

Written procedures have been established for use in emergency situations. These cover most natural occurrences in addition to fire related malfunctions. The basic plan for emergency egress is first to use the stairway and secondly either use the elevator or go to the ledge at the cab level.

Security

The ground level entrance door is kept locked at all times. Proper identification is required before being admitted to the tower. In addition, the airport facility is enclosed in a 7' woven wire fence. The airport gates are kept locked from 11 pm to 6 am.

CONSTRUCTION

General Description

The tower is a Southern Region Design consisting of 7 stories plus cab building with a plan area of 625 sq.ft. (25'x 25') in all stories. The clear floor area is approximately 420 sq.ft. The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are poured concrete on a steel pan and the Cab roof consists of a built-up steel deck.

Exterior walls are steel panels apparently of an insulated sandwich construction. The cab has mostly tempered glass walls and partially asphalt protected metal siding. Interior partitions are constructed of concrete blocks. Suspended ceilings are provided.

Horizontal and Vertical Fire Separation

All rooms or areas on floors 1 through 7 open into the stairwell which an open shaft from the 1st to the 7th floors. This is a concrete block and steel constructed shaft with steel stairs and supports. The 2 interior walls are concrete block and exterior walls are formed by the exterior tower walls. All doors opening into the stairwell are all metal but not fire rated. The elevator shaft also opens into the stairwell through all metal doors with a 6" by 12" wired glass and metal frame observation window in the door. The elevator shaft ends at the 6th floor. The stairwell should provide a good means of emergency egress providing advance warning is available and before the tower would be heavily involved in an occurrence.

Vertical Shafts

(For stairwell discussion, see the preceding section.) The tower has an elevator shaft and a cable chase. The elevator shaft (Floor 1-6 only) is concrete block and steel enclosure. The 2 interior walls are concrete block and the 2 exterior walls are formed by the tower walls. The elevator shaft is open at the first floor thus any fire in that area would involve the whole shaft area with smoke. The cable chase is an all-metal enclosure of about 5" by 36" going from the first floor to the cab level. The top and bottom floor levels of this cable chase is not sealed and thus an occurrence on the first floor level could product smoke in the cab. (This also would be true of any in-chase electrical fire or short circuiting).

Interior Finishes

There are no unacceptable interior finishes, the walls have no finishing materials, the floors utilize carpeting and vinyl tile in some areas, suspended ceilings where provided are of ordinary mineral lay-in tiles on metal frames. The fire characteristics of these materials is unknown.

UTILITIES

HVAC

No central system is provided. Cooling and heating combination window units are provided individually for the various rooms and floors. There is, however, a central unit provided on the seventh floor which provides the heating and cooling for the Cab level.

Electrical

Electrical power is purchased from the Florida Power and Light Company entering through the 1st floor main distribution panel at 120-208 volts 60 cycle 3 phase. There are no transformers on the premises. The major use in the tower is 120 volts. An 375 KVA emergency generator, diesel engine driven with an outside buried fuel tank is provided to maintain the radio facilities and emergency lighting only. Power and signal wiring distribution is through an all metal electrical chase. Power wiring is in conduit and the signal wiring open PVC insulated. The telephone equipment (TELCO) room is located on the second floor. This equipment is all low voltage.

Fire Protection Water Supply

There is no in-tower fire water system. Fire water is supplied to the airport by the City of Miami. Some hydrants are available.

EXITING FACILITIES

There are two normal egress methods, the stairwell and/or the elevator. The Cab floor level is about 90' making the elevator the preferred normal method from most levels. In an emergency, there is also available an outside ledge with access from the cab level only. It would be necessary to secure outside help for removal of personnel from the ledge to the ground. This procedure can only be considered a last resort method. The Cab level has access to the stairwell only through the mechanical equipment room on the 7th floor. Elevator service terminates on the 6th floor and, of course, it is necessary to go to this level for elevator service from the Cab or 7th floor. On floors 1-7 the common elevator-stair shaft is separated from other floor areas by a single hollow metal nonfire rated door. The emergency lighting system is powered by the standby emergency generator on the first floor. There is no exit signing.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of 15-lb. CO₂ fire extinguishers. There are no class A units available for office and cab occupancies.

Detection and Alarm Systems

None. The fire department would be summoned by telephone or by going directly to the adjacent fire station.

Automatic Extinguishing Systems

None

OCCUPANCY

Occupancies are typical of the small tower consisting of:

First Floor (420 sq.ft. net floor area - ground level)
Electrical equipment room which has the emergency generator, incoming power distribution panel and there is an elevator machinery room.

Second Floor (420 sq.ft. net floor area - floor elevation estimated to be about 12'): The entire occupancy is taken up by the Telco Room.

Third Floor (420 sq. ft. net floor area - floor elevation estimated about 36'): The radio equipment room is the entire occupancy, and has the relay and transmitter racks and the keying units.

Fourth Floor (420 sq.ft. net floor area - floor elevation estimated about 36'): The radio equipment room is the entire occupancy, and consists of the very high frequency radio receiver relay rack.

Fifth Floor (420 sq.ft. net floor area - floor elevation estimated at 48'): The entire occupancy is taken up by the Chief's office.

Sixth Floor (420 sq.ft. net floor area - floor elevation estimated at 60'): The entire occupancy is taken up by the Cab Ready Room.

Seventh Floor (300 sq.ft. net floor area - floor elevation estimated at 72'): The occupancy is mostly taken up by the equipment room for air conditioning equipment for the Cab.

The Cab level (500 sq.ft. net floor area - floor elevation estimated at about 90'): Radio flight approach control over approximately 5 miles radius of the tower. No radar equipment is provided.

Costs for implementation
of Recommendations
(No. 25-SRD)

1.	\$3600
2.	\$ 250
3.	<u>\$2000</u>
TOTAL	\$5850

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FIRE PROTECTION ENGINEERING SURVEY OF AIR TRAFFIC CONTROL TOWER--ETC(U)

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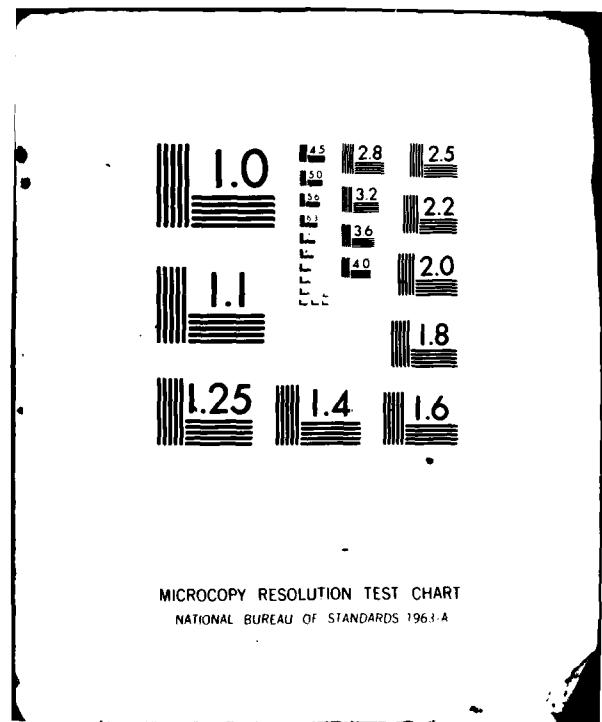
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REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 26-WB

LOCATION: DALLAS-FT. WORTH REGIONAL AIRPORT

SURVEY DATE: JUNE 14, 1976

SURVEYING ENGINEER: JOHN L. CARLSON, P.E.

FAA PERSONNEL CONTACTED: H. DOEBLER - TOWER CHIEF
N. SCROGGINS - DEPUTY CHIEF
A. GRANHART - A.F. TECHNICIAN

CONCLUSIONS

The tower is generally adequately arranged and has a reliable escape means from the upper levels. However the means of egress from the base building is inadequate. With the installation of an additional ground floor protected exitway and complete detection and alarm system an adequate emergency exit system would be provided.

RECOMMENDATIONS

1. Products of combustion detection and alarm systems should be provided in the mechanical and electrical shafts, the entire base building, and the upper tower levels. This should include facilities for the automatic shut-down of air handling units. A partial alarm system is provided in the Base Building which has no shut-down functions.
2. All internal doors in the following areas of the Base Building should be equipped with fire doors equivalent to a 1-1/2 hour fire rating. Existing doors are ordinary hollow metal units with no fire rating. This would include such areas as Rooms 12, 13, 14, 157 18, 19, 24, 27, 51 & 58. These are equipment areas that expose less hazardous areas as well as escape routes in some cases.
3. The opening in the electrical shaft on the Microwave Level should be refitted with a 1-1/2 hour rated fire door, which has been removed.
4. Provide an additional egress corridor to reduce excessive (over 100 ft.) travel distance. This should be located in the southwest corner of the building. A 1 hr. equivalent rated corridor should be provided from door B-54 in corridor 57 to the outside door B-57. A 1 hr. equivalent rated door should be provided for access to this new corridor from Radar/Computer area 49.

The following items are desirable for improving fire and life safety protection but are not considered essential to the overall emergency egress program.

- A. Class A fire extinguishers (equivalent to a 2-1/2 gallon water unit) should be provided in all areas. One unit would be adequate for the upper levels and enough units should be provided in the base building so it will not be necessary to go more than 75' to reach an extinguisher.

B. Special protection should be considered for the Electrical Service Vault which houses the two 500 kva transformers. This could include inert gas, halon, or water systems.

C. All telephones should have emergency call numbers listed in the immediate area.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The airport became operational January 13, 1974, however the tower had been active since July of 1973. The tower is located essentially between the two north south main access roads with the main runways located to the east and west. The terrain is level in all directions with no obstacles. There are no other terminal area structures in the immediate vicinity of the tower. The area is subject at times to severe climatic conditions consisting principally of hurricanes and tornados.

Fire Fighting Services

The entire airport complex is located on land jointly owned by the cities of Dallas and Fort Worth. The airport, however, is well beyond the corporate limits of either of these two cities. Due to the vast size of the airport, there are several municipalities in the area which have public response jurisdiction. However, the airport has its own fire department consisting of three stations with full crash capability as well as routine fire fighting facilities. Two of the stations are manned 24 hours per day.

Hours of Operation and Personnel Loading

The tower is operational on a 24 hour per day basis with at least 11 personnel on duty at all times. There is a total employment of about 120 operational (AT) employees and about 12 maintenance (AF) for a combined total of approximately 132. The main activity is day time when the normal load is seven in the Cab and 35 in the Base Building. At other times, there are normally seven in the Cab and 4 in the Base Building. Maintenance personnel normally are on duty day times only. The normal shift load is 54 day times and 11 on each of the other shifts.

Self Inspection

A formal inspection program has been established consisting of semi-annual general inspections and monthly inspections of fire extinguishers. Fire extinguishers are serviced as required on an annual basis.

Emergency procedures

Written procedures have been established for use in emergency situations. These cover most natural occurrences in addition to fire related malfunctions.

Security

The main entrance door of the Base Building is locked at all times. Proper identification must be provided in the reception area before being admitted to the main part of the facility. The door to the staircase to the Cab level from the Junction level is on a push-button code station to release the always latched door. The general outside area of the tower is not secured and is accessible from any of the airport public roadways.

CONSTRUCTION

General Description

The tower is a Southwest Region Design (Welton Becket) consisting of a large ground floor with two upper floors plus a cab. The Base Building is rectangular in shape and the other floors are roughly circular with set-back walls. Thus, the floor areas vary from an approximate gross area of 31,000 sq.ft. for the Base Building to 370 sq.ft. for the Junction level.

The entire building tower complex would class as noncombustible construction (NFPA 220). The Base Building is of mixed construction, the walls consist of pre-cast concrete, aluminum, glass window, hollow metal or louvered steel panels. The roof is pre-cast concrete beams with a built-up covering, the floor is 6 inch concrete slab and partitions are generally gypsum wallboard on steel studs. Ceilings are open in mechanical areas and suspended in other areas.

The Microwave level has sandwich wall construction with metal exterior, gypsum wallboard interior and with a rigid insulation in the center. Floors are concrete on steel supports and with open ceilings except for the hallway which is suspended. The Junction level is of similar construction except the walls are primarily glass in metal frames and the ceiling is completely suspended. The Cab has about half glass and half metal walls with metal floor and roof with suspended ceiling and carpeting on the floor.

The tower proper consists of four approximately 10' square concrete shafts which serve as the support for all upper levels. The four shafts in addition to providing load bearing support, for all upper levels including the cab, serve as mechanical, electrical, stairwell and elevator shafts (See Vertical Shafts).

Horizontal and Vertical Fire Separation

In the Base Building mechanical and electrical equipment rooms are separated from adjacent areas by concrete block walls or gypsum wallboard on steel studs. Hallway construction is generally of gypsum wallboard on metal stud, with wood doors in most areas except to the above mentioned mechanical and electrical areas which have blank walls basically on hallways with hollow metal doors where not blank. The Junction level has a short central corridor

connecting the elevator and stair shafts constructed of gypsum wall board on 4" metal studs. Hollow metal doors are provided to the equipment rooms and the shafts. The Junction level is of similar construction except the corridor is on the periphery of the floor area. The Cab level has an open floor area with a steep winding 3' wide staircase to the Junction level with a hollow metal door at the bottom only.

Vertical Shafts

The tower has four shafts, two of which would be essentially smoke proof. These are the stair and elevator shafts. The elevator stops at the Micowave level and there is no elevator service to the two levels above this. The stair shaft ends at the Junction level with a separate and cut-off staircase to the Cab. Doors are ordinary (i.e. not fire rated) hollow metal in all cases. There are two equipment shafts, one primarily for electrical and the other for mechanical equipment. These two shafts are completely enclosed with hollow metal doors at all levels for servicing access. However, the door from the electrical shaft to the Microwave level has been removed.

Interior Finishes

There are no unacceptable interior finishes. All levels have various floor coverings and partial suspended ceilings. Floor covering generally consists of vinyl tile or carpeting and the suspended ceilings are mineral lay-in tile in steel frames.

UTILITIES

HVAC

Heating and cooling requirements are provided from the airport utility system. Hot and cold water systems are provided. There are coils in the 8 air handling units provided in the base building. These units circulate the air over the coils and throughout the zone of application by ducts. The cooling system is similar, however, utilizing cold water. There is 200 T cooling capacity off the airport system. The tower however has 160 T of back-up or reserve capacity, provided in standby units located in the open and south of the base building. There are 8-25 HP compressors provided in this cooling station. There is an additional 15 T unit provided on the Juncion level supplied by a 20 HP compressor in reserve for the Cab only. The air circulation is through insulated metal ducts and distribution vents in the concealed space above the suspended ceilings. There is no air circulation between floor levels. Hot and cold water piping systems,utilizing the mechanical shafts, supply the air handling units on the upper levels.

Electrical

Electrical power is purchased from a local public utility company. There is a two source supply to the airport area. The incoming power at 25 KV is reduced in two 500 KVA utility owned transformers (located in the Base Building service vault room) to secondary voltages of 480, 277, 208 and 120 depending on the user. There

is some distribution at 480 that is further stepped down in area of use by smaller units rated from 30 to 75 kva. A battery rack is provided for the radio system only and is capable of providing a 30 minute operation. There is also an emergency generator rated at 500 KW diesel-engine driven. Thus, unit is capable of supplying, in an emergency power outage, all electrical needs with the exception of office lighting and air handler No. 5. All electrical facilities are adequately arranged, most wiring is open, PVC insulated i.e. no conduits. Transformers, electrical generating facilities, etc. are adequately arranged in fire resistive rooms however not completely cut-off or separated from other areas in that non-fire rated hollow metal doors are used on openings. The Telco room is also located in the base building, in a separate room adequately segregated from other facilities.

Fire Protection Water Supply

There is no in tower fire water system. Fire water protection is apparently supplied from the airport water system. There are two double hydrants with pumper connections located in front of the base building.

EXITING FACILITIES

The normal egress method from the tower is the elevator for all the upper levels. For Cab personnel to reach the elevator, it is necessary to pass through the Ready and Machine Rooms on the Junction Floor. In an emergency, all levels have access to the stairshaft. Cab personnel have a separate staircase to the Junction level corridor before reaching the main stairshaft. The base building has two exit doors and some travel is over 100 feet from an outside doorway. All the tower and base building essential lighting facilities are on the emergency power circuit. There is no exit signing.

PROTECTION

Manual Fire Fighting Facilities

The tower has a first aid fire protection only consisting of 15 lb. CO₂ units except the Cab which uses 5 lb. units. There is a deficiency of Class A units throughout the tower and some deficiency in the Base Building which has inadequate distribution. Fire extinguishers receive monthly inspections with recharging, servicing, etc. on an annual basis.

Detection and Alarm Systems

The upper tower levels have no detection or alarm systems. The Base Building has a small alarm system with three manual actuation stations provided. Ionization type products of combustion detectors are provided in the discharge of 7 of the 8 air handlers. In

addition to the local alarm, there is remote supervision by the airport fire department. The cab is equipped with a direct telephone line to the airport fire and security departments.

Automatic Extinguishing Systems
None.

OCCUPANCY

Occupancies are typical of a large tower with a base building facility which consist of:

Base Building (2,000 sq.ft. net floor area-ground level): This floor houses the facilities of operations administration (AT) and the maintenance and utilities equipment and administration (AF). These consist of mechanical equipment rooms, electrical equipment and switchgear rooms, emergency generating facilities, shops, radio equipment room, Tracon room, radar/computer room, Telco room, and several offices as well as personnel use areas such as ready rooms, locker rooms, conference rooms, etc.

Microwave Level (660 sq.ft. net floor area - floor elevation 150'): Consists of approximately 2 equal areas, housing equipment racks for the Microwave facility. Antennas are located outside on the floor overhand area.

Junction Level (350 sq.ft. net floor area - floor elevation 165'); The floor is divided into several small rooms or areas consisting of machine room, cab-ready room, water closets and the top of the elevator shaft housing the hoist works and is part of the machine room.

Cab Level (600 sq.ft. floor area - floor elevation 180'): Air Control personnel and their operational equipment.

Costs for Implementation

of Recommendations

(No. 26-WB)

1. \$8000

2. \$5000

3. \$ 500

4. \$1000

TOTAL \$14,500

REPORT OF
FIRE PROTECTION ENGINEERING SURVEY
FOR LIFE SAFETY ANALYSIS
OF AIR TRAFFIC CONTROL TOWERS

REPORT NO: 27-WRD (Western Region Design)
LOCATION: SAN JOSE, CA - REID-HILLVIEW AIRPORT
SURVEY DATE: AUGUST 20, 1976
SURVEYING ENGINEER: GLENN D. PETERSON
FAA PERSONNEL CONTACTED: HAROLD R. FEDERWISCH - TOWER CHIEF

CONCLUSIONS

The tower lacks any reliable internal escape means (stairwell). An escape door on the cab level leads to an exterior walkway, where escape requires outside help or use of a rope and sling system. Time requirements and reliability make these last resort procedures. Provisions for reliably enclosing the staircase at the 1st and 2nd floors and the installation of a products of combustion detection and alarm system would provide for an adequate emergency egress system.

RECOMMENDATIONS

1. An automatic products of combustion detection and alarm system should be installed throughout the tower including all shafts and spaces above suspended ceilings. This should include automatic shut-down of all air handlers.
2. All openings including doors from the cable shaft to other areas or rooms should be protected, in a manner to be equivalent to 1-1/2 hour fire resistance rating and be smoke tight.
3. All doors opening onto the stairwell should be equipped with a self closer.

The following items are desirable for improving fire-life safety protection but are not considered essential to the overall emergency egress program:

- A. A Class A type fire extinguisher (equivalent to 2-1/2 gal. water unit) should be provided on the 1st and 3rd floors.
- B. All telephones should have emergency call numbers listed.
- C. The stairwell and room beneath the stairs (1st floor) was being used to store some combustible and flammable materials. This material should be stored in a "non-operational" area.

- D. There is a need for a more frequent, improved self-inspection program.
- E. Combustible exposures to the north of the tower should be relocated.
- F. The rope and sling system should be mounted outside in a weather-proof cabinet and all occupants should periodically put on the harness and become familiar with the equipment, if this is to be of any value.
- G. Combustible storage should be removed from the first floor lobby.

GENERAL ASPECTS

Site Features, Conditions and Exposures

The tower was built in 1967 and is located on the west edge of the airport. There are no exposures to the east or south; however there are houses approximately 100 feet to the west and the space to the north is being rented for use as a storage yard. Some combustible storage is stacked adjacent the fence within 15-20 feet of the tower. The area is not subject to severe climatic conditions, but is subject to earthquake hazards.

Fire Fighting Services

The airport is County owned but is completed surrounded by the City of San Jose and receives full public protection from the City. The nearest fire station is located approximately 16 blocks away and aid would be available in about 5 minutes.

Hours of Operation and Personnel Loading

The tower is operational from 7 AM to 11 PM with between 2 and 7 persons on duty at all times. Maximum occupant loads are: Cab - 4 or 5, 2nd Floor - 2, 1st Floor 3.

Self Inspection

There is no formal self inspection program of significance. There is a semi-annual in tower inspection for fire and safety hazards. Fire extinguishers are checked and serviced as required and on an annual basis. Due to the small size of the facility and limited personnel, elaborate procedures are not required.

Emergency Procedures

A direct line exists to the Santa Clara County communications center which dispatches all necessary equipment. Occupants do not practice using extinguishers or the escape sling.

Security

The ground floor main entrance door is kept locked at all times. Proper intercom identification is required before being admitted to the tower. A wire fence system encloses the tower and environs. The access gate to the fenced area is not locked during working hours.

CONSTRUCTION

General Description

The tower is a 30' type "L" with 2 stories plus cab of a pentagon configuration. All floor areas are approximately 440 sq.ft. gross. Floors 1 and 2 each have a vertical shaft for stairs and cables approximately 130 sq.ft. area.

The building is of noncombustible construction (NFPA 220). The structural frame is unprotected steel, floors are poured concrete on steel pans and the cab roof is tar and gravel over a steel deck. Most exterior walls are stucco and gypsum board. Cab walls are tempered glass in steel frames (upper) and aluminum over plywood (lower). Interior partitions are of noncombustible construction, i.e. gypsum board on metal studs (except 2nd floor office has paneling).

Horizontal & Vertical Fire Separation

All rooms or areas on Floors 1 and 2 open onto the staircase which extends from the 1st floor to the cab. Doors to the office (2nd floor) and cab are rated 1-1/2 hour and are equipped with self closers. Doors to the restroom (2nd floor) and telephone equipment room (1st floor) are unrated and without self-closers. The stairwell has a steel staircase with concrete filled treads. Each floor would be essentially separate fire areas if shafts are cut off.

Vertical Shafts

For stairwell discussion, see the preceeding section. There is no elevator shaft.

The tower has a shaft for electrical and signal wiring and utility piping. The shaft is open from the 1st floor to the cab. The shaft has open (unsealed) penetrations into room areas on most floor. There are solidcore wood doors approximately 1-1/4" thick (no automatic closures but normally closed and locked) for access on each floor.

Interior Finishes

Most interior finishes are acceptable. Floors have tight weave carpeting and vinyl tile in nonmechanical-utility areas (i.e., offices, training rooms, cab., etc.) Walls in the 2nd floor office have been covered with 1/4" unlabeled particle board paneling. Fire characteristics of these materials are unknown. First floor ceilings are open. The cab and second floor ceilings are suspended mineral lay-in tiles on steel frames.

UTILITIES

HVAC

Hot water is piped to other floors via the utility shaft. There are no gas utilities present. Floors 1 and 2 are air conditioned with small individual units. A larger unit on the cab roof supplied the cab.

Electrical

Electrical power is purchased from Pacific Gas & Electric Company. Power is received at 208 volts. Distribution is from the 1st floor main distribution panel to the cable shaft for distribution to all floors through some unprotected openings. Emergency power is via 12 volt batteries and is sufficient to operate equipment for 36 hours.

Power wiring is mostly in conduit with the other wiring (low voltage) open (PVC, AWG, and THW insulation). The telephone room (TELCO) is also located on the 1st floor.

Fire Protection Water Supply

There is no in tower fire water system. Water for fire protection is provided from the City of San Jose water distribution system. The nearest fire hydrant is two blocks distant.

EXITING FACILITIES

The stairwell is the only normal egress method as there is no elevator. The stairwell should be fire and smoke safe for a reasonable egress time with the exceptions of doors lacking closers (Telco and restroom) and storage at the bottom of the stairwell. All room doors are normally kept closed, but have stops and could be left open. In an emergency, a rope and sling unit is also available. The access door is in the exterior wall. Essential lighting is provided by the emergency power system and individual battery powered units. There are no exit signs.

PROTECTION

Manual Fire Fighting Facilities

The tower has first aid fire protection only consisting of 15 lb. CO₂ and 2-1/2 gallon water fire extinguishers. There is a deficiency of Class A units, at the cab and first floors.

Detection and Alarm Systems

NONE. The San Jose fire department would be summoned by a direct line in the cab and dial telephones from other tower areas. In-tower (other than in the cab) procedures for transmitting alarms is not clearly established.

Automatic Extinguishing Systems

NONE.

OCCUPANCY

Occupancies are typical of a small tower and consist of:

1st Floor: (270 sq.ft. net floor area - floor elevation 0'6"): Locker and equipment room (the largest and main area)

which contains recording equipment, dry electric transformer, incoming electrical distribution power panels, batteries and rectifier, lockers, refrigerator, and storage cabinets. Batteries are vented to outside through a plastic tube. Telco Room - telephone switch gear and storage.

2nd Floor: (243 sq.ft. net floor area - floor elevation 12'6"):
Consists of an office, 2 storage closets and a restroom.

Cab Level: (402 sq.ft. net floor area - floor elevation 28'6"):
Radio and radar consoles, a stove and oven.

**Costs for Implementation
of Recommendations
(No. 27-WRD)**

1.	\$4500
2.	\$1500
3.	<u>150</u>
TOTAL	\$6150

